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ERRATA

page xii, column 1, line 22
for ANECOCHEILUS read ANECOCHILUS

page xxii, column 2, line 14
for *(L.) Merr.* read *(L.) Pierre*

page 4, line 4
for Cypripediums read Cypripedium

page 5, line 3
for Cypripedium read Cypripediums

page 19, lines 12 and 14
for *Gyrostachys* read *Gyrostachis*

page 20, line 25
for Granada read Grenada

page 53, line 9
for enhances read enhance

page 56
page number reads [54] should be [56]

page 56 (alias 54), lines 9 and 12
for Bernadino read Bernardino

page 56 (alias 54), line 24
for extirpacio read extirpación

page 67, line 8
for D.S.D. read D.S.C.

page 80, line 19
for distinguish read distinguishes

page 91, line 24
for Semen. read Semin.

page 94, line 3
for Semen. read Semin.

page 97, line 4
replace (*Linn.*) *Merrill* Interp. Herb. Amb. (1917) 271 by (*Linn.*) *Pierre* Fl. For. Cochinch. (1899) sub t. 385 in obs. Cajo pinnatum

page 99, line 4
for Semen. read Semin.

page 106, line 25
for (1889) read (1829)
page 114, line 10
for 1754 read 1854
page 139, line 33
for lead read led
page 140, line 12
for obtegentes read obtegentia
page 142, line 1
omit to after allied
page 143, lines 22-23
for pyriformis read pyriformes
page 144, line 24
for latae read late
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for narrowly read broadly
page 146, line 6
for 25 read 36
page 147, line 13
for hardily read hardly
page 148, line 20
for scrotoform read scrotiform
page 152, line 11
for inaequalibris read inaequalibus
page 183, line 10
for Saertyrk read Saertryk
page 184, line 20
for Vanoid read Vandoid
page 188, line 22
for Andian read Andean

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CYPRIPEDIUM CALCEOLUS VAR. PUBESCENS

BY
DONOVAN S. CORRELL

THE TAXONOMIC and nomenclatorial history of our yellow Cypripediums (*Cypripedium parviflorum* and *C. pubescens*) is most perplexing because it is burdened with the conflicting opinions of both European and American botanists. Beginning in 1791 (Trans. Linn. Soc. 1: 77) with Salisbury's first segregation of a North American yellow Cypripedium from the Eurasian *C. Calceolus* L., botanists have been confused as to the true status of our so-called species and varieties. Salisbury's basis for separating *C. parviflorum* from *C. Calceolus* was concerned mainly with the shape of the staminodes. Later, when Willdenow (Hort. Berol. 1 (1804) t. 13) established *C. pubescens* as being different from *C. parviflorum*, he relied for the most part on differences which he noted in the lobes of the column. In making this segregation, Willdenow opened the way for later botanists to invent numerous varietal and specific names for the yellow Cypripediums of North America. W. J. Hooker (Bot. Mag. 57 (1830) t. 3024) disagreed with Willdenow concerning his basis for the separation of *C. parviflorum* and *C. pubescens*, saying that he found the lobe of the column "to be the same in both, or to possess only occasionally trifling differences." Hooker proposed instead that the shape of

the lips should be used as the basis for the separation of the two species. He stated that the lip was dorsi-ventrally compressed in *C.parviflorum* and laterally compressed in *C.pubescens.*

From the above remarks, one might surmise that both Willdenow and Hooker, as well as Salisbury, had a limited amount of material from which to draw their conclusions. Indeed, it is very possible that each of these men had in hand a different form of the North American plant.

In attempting to segregate a large number of herbarium specimens of our yellow Cypripediums into their respective specific or varietal categories, I have been completely baffled. It seemed, therefore, advisable to review all available literature on the subject in an effort to solve the problem. In doing so, I have been impressed by the comparatively few efforts which have been made to solve this puzzling problem. Although many authors have ventured opinions of doubt concerning the specific rank of *C. parviflorum* and *C. pubescens*, most of them have blindly adopted the European concepts of our plants. In the following pages I have recorded some few of the opinions which have been broached by various writers from time to time. I have also proposed a new status for our North American yellow Cypripediums.*

In trying to separate *C. flavescens* from *C.Calceolus*, de Candolle (Redouté Les Liliacées (1802) t. 20) said that the yellow-flowered slipper was a great deal like the slipper of the Alps *(C. Calceolus)* and that one would take it at first sight for a simple variety of this plant. He ended by separating the two plants on the basis of coloration of the flowers, on the shape of the staminodes, and on their geographical distribution.

*This paper is concerned only with those species found north of Mexico.

Sims (Bot. Mag. 23 (1806) t. 911) published an illustration of the plant which he knew at the time as *C. parviflorum.* He stated: "It comes very near to the European species, and we suppose has been mistaken for the same by Michaux [Flora Bor. Am. (1803) 161]. . . . The nectarium or slipper is of plain yellow color without veins." Later botanists referred to Sims' illustration as representing *C. pubescens.*

Rafinesque (Med. Flora U. S. (1828) 142) combined all the North American yellow Cypripediums into one species which he called *C. luteum.* Along with other characters, he said that the staminode was flattened into an oblong-deltoid lobe, and that the lip was yellow with or without red spots. He added: "Many botanists have made two species, *C. pubescens* and *C. parviflorum* of this, to which the previous [?] and better name of *C. luteum* ought to be restored. I have ascertained that they form only one species, affording many varieties. . . ." He also cited eight varieties and gave a short varietal description of each. In conclusion he said: "A multitude of intermediate varieties or deviations may be seen, with undulate or spiral sepals, obtuse or acute lobules, broader or narrower leaves, ..." Later (Atlantic Journ. 1 (1833) 178), in spite of his rather broad species concept as shown above, Rafinesque described a plant from Arkansas as *C. bifidum*, which form seems to be the same as later described by Cockerell and Barker (Proc. Biol. Soc. Wash. 14 (1901) 178) as *C. veganum.* Both are now referred to *C. pubescens* by some authors.

In 1840, Lindley (Gen. & Sp. Orch. Pl., p. 525) admitted that *C. parviflorum* and *C. pubescens* were very difficult to distinguish when dry, adding that both were closely allied to *C. Calceolus.* His characters for separating the two were not very strong, consisting chiefly of a difference in size of the flowers. It would seem that after

Lindley's apparent admission of the weakness of the characters used to segregate these so-called species, following workers would have clarified the situation. In my opinion, Pucci (Les Cypripediums (1891) 165) stopped just short of the solution when he said that *C.parviflorum* appeared to be a variety of *C.pubescens* with smaller flowers, and that *C.pubescens*, itself, was somewhat like *C. Calceolus*. In fact, he thought it to be probably only a variety with larger flowers. However, Pfitzer, in 1903 (Orchidaceae-Pleonandrae in A. Engler Das Pflanzenreich, p. 33), still retained all three species and segregated them according to the following key:

Staminode oblong . . . . . *C.Calceolus*
Staminode triangular
  Lip laterally compressed . . . . . *C.pubescens*
  Lip dorsally compressed . . . . . *C.parviflorum*

Since it is probable that European botanists have based their conclusions upon too little material, it will be of interest to include in this discussion some of the observations and viewpoints of botanists and naturalists of this continent who have had ample opportunity to observe our yellow Cypripediums in the field.

As early as 1889, Watson and Coulter (Gray's Man. Bot. ed. 6, p. 511) realized the difficulty involved in distinguishing *C.pubescens* from *C.parviflorum*. They wrote of *C.parviflorum*: "Flowers fragrant; sepals and petals more brown-purple than in the next [*C.pubescens*], into which it seems to pass."

Although Miss Lounsberry (Southern Wild Fls. and Trees (1901) 73) noted striking intergrading of the two so-called species, she followed tradition in retaining them as separate entities. She said: "Occasionally, when it [*C.parviflorum*] is unusually well grown and its relative [*C.pubescens*] is somewhat undersized, they might almost be taken for the same species, were it not that the little

one is fragrant and has a lip of a deeper shade of yellow.''

Rydberg (Torreya 2 (1902) 86), writing in defence of his key to the yellow Cypripedium in Britton's *Manual of the Flora of the Northern States and Canada* (1901) p. 290), arrived at the following conclusions:

''1. That *C. hirsutum* Mill. has been rightly understood by me, and wrongly so by the English botanists and by Gray.

''2. That either do we have three species of yellow lady's slipper, one large and one small-flowered, both with vertically flattened lip, and a third medium-sized one with laterally flattened lip; or else was *C.parviflorum* Salisb. a small flowered form of *C.hirsutum.*

''3. In either case, the one with laterally flattened lip is neither *C.pubescens* nor *C.parviflorum.*

''4. If there are three species their names . . . would be as follows:

1. *C.hirsutum* Mill. . . .
2. *C. flavescens* [de Candolle]. . .
3. *C.parviflorum* Salisb. . . . ''.

Miss Niles (Bog-trotting for Orchids (1904) 57) arrived at practically the same conclusions as those of Rydberg. She said: ''There seem to be three different forms of the Yellow Cypripediums, although there are but two distinct North American species north of Mexico; these appear also to intergrade frequently. Close association of habitat has probably something to do with this cross-fertilization of the two species.'' She also said: ''Finding the two marsh plants, *Cypripedium hirsutum* and *Cypripedium parviflorum*, growing side by side in the Swamp of Oracles [Vermont], I observed marked intergrading, . . . the large species, *Cypripedium hirsutum*, producing variegated sepals and petals, or possibly now and then a brown-pink petal or sepal, imitating the type species of

the smaller moccasin-flower. Both species were fragrant in a slight degree, *Cypripedium parviflorum* being, of course, the more fragrant of the two.''

In 1905, House (Bull. Torr. Bot. Club 32: 374) was inclined to follow Rydberg's conclusions entirely. He said that an examination of fresh specimens during a period of two years led him to believe that there were three species of yellow lady's slipper. He recognized *C.pubescens* as a distinct and definite species. However, he admitted that *C.parviflorum* ''. . . differs from *C.pubescens*, apparently in size only, and is usually found in more swampy situations than *C.pubescens*. Conservative treatment may reduce this to a variety of *pubescens*.'' House also accepted de Candolle's *C. flavescens*, saying that it is ''. . . a species of shady ravines and moist rich woodlands, of decidedly more boreal distribution than the last [*C.parviflorum*], which seems to follow quite closely the range of *C.pubescens* Willd. In addition to the laterally flattened (the greatest expansion being vertical) lip, the lip is often subglobose and conspicuously ascending, and the leaves narrower and more ascending, than in the yellow-flowered species of our flora.'' After having written in 1918 (Wild Flowers of New York, p. 66): ''Since numerous intermediate forms occur it is probable that they [*C.parviflorum* and *C.pubescens*] represent forms of a single species'', House, in 1924 (Annot. List of the Ferns and Flowering Pl. of N.Y. State, p. 235) admitted each of them to specific rank, and at the same time said: ''I am now inclined to regard it [*C.flavescens*] as an intermediate form or possibly a hybrid between *C.parviflorum* and *C.pubescens*.'' Herein, House simply exemplifies the confused state of mind or indecision of most botanists in regard to these plants.

A most interesting observation is recorded on a sheet in the Ames Herbarium by A. B. Klugh, at the time

(1906) editor of the *Ontario Natural Science Bulletin*. He said: "My observations on *C.hirsutum* lead me to believe that the so-called species *C. parviflorum* is a mere form of *C.hirsutum* and not even worthy of designation as a variety. While a sweet scent is usually found in the smaller forms and not in the larger I cannot connect this odoriferous quality with either a dorsally or laterally flattened labellum. The smaller form is here usually found in the drier and shadier situations and the larger in the wetter and more open locations. At the same time I have found small, sweet-scented plants among the larger ones in open bogs."

It is interesting to note that Klugh also reversed the usual habitat attributed by most botanists to *C.parviflorum* and *C.pubescens.*

In 1906, Knight (Rhodora 8: 93) made the most constructive suggestion offered up to that time by saying: "I have long doubted their specific distinctness", and reducing *C.pubescens* to *C.parviflorum* var. *pubescens*, ". . . in order that its exact relationship be better expressed." In his very interesting paper, Knight said: "Study of the plants growing in the field and also of some under cultivation in the garden would seem to prove that we have at best a species, *C. parviflorum* Salisb., which would appear to be our small flowered plant which has commonly passed under this name, while the larger flowered form would appear to require the name, *Cypripedium parviflorum* var. *pubescens*, . . . ". He continued by citing experimental and observational data supporting his convictions: "On May 30, 1901, Mr. F. M. Billings found a clump bearing eleven flowering stalks which could be referred under the description in the current manuals to no other species than *Cypripedium pubescens.* They agreed perfectly with the descriptions in size of flower, compression of lip, shape of foliage and

all characters except color of the blossoms which were bright, not pale yellow. These plants were growing in very rich soil in low shady woods. A portion of the plant was pressed and three flowers from it are now in my herbarium. Mr. Billings transplanted part of the cluster into his garden, putting them into less rich soil and in a sunnier spot than where they naturally grew. In 1905 the characters of these plants were so far changed that they would pass very well for the small-flowered plant, *Cypripedium parviflorum*. The whole plant had become shorter and slenderer with narrower foliage, the lips of the flowers less than an inch in length (some were two inches at the time when transplanted), lips not appreciably flattened laterally and in fact not any longer possessing the characters of the large-flowered plant."

Knight continued by saying that for some few years he had annually transplanted into his garden clumps of plants which agreed in all essential characters with *C. parviflorum*, although some superficial differences were noted, such as various shades of color in the lip. After five years he found that the plants, with regard to foliage and flowers, had increased in size to the extent that they resembled *C. pubescens*. The plants, which were originally found in moss in a cold bog and had flowered later than the middle of June, after being transplanted into very rich soil in a sunny exposure were seen to flower as early as the third week in May. Nearly all the stalks bore two flowers, whereas they had originally borne rarely more than one flower. He also made the interesting observation: "One season two stalks from the same plant bore flowers whose lip on one stalk was laterally compressed while on the other it was strongly compressed from above, there being one flower on each of these stalks." (Professor Ames tells me that he has observed both of the above-mentioned types of flowers growing on the

same stalk). Citing observations made while studying the plants in their natural habitats in Maine, Knight said: "I have repeatedly found many which were intermediate in characters between *Cypripedium parviflorum* and *C.pubescens* and in most instances plants readily referable to one or the other form (sometimes both forms) were growing with these intermediates." He mentioned several intergradations and said that, in fact, almost every combination of characters could be found. He ended his most interesting argument with the statement: "Unless the numerous specimens possessing characters of both forms can be accounted for on the grounds of hybridism we ought to regard them as different phases of the same species."

It is my opinion that Knight's experimental evidence contradicts his final conclusions. If these experiments and observations are correctly interpreted it seems to me there could be but one conclusion: *A multitude of ecological forms but only one species!*

Rolfe (Orch. Rev. 55 (1907) 184) corroborated, in part, Knight's observations. He said: "*C.pubescens* has much larger flowers, sepals and petals often lighter in colour and the lip somewhat compressed laterally, but nearly all the books agree that they intergrade and both forms are now flowering at Kew [England] out of the same batch of roots." He continued: "I think they [*C. parviflorum* and *C. pubescens*] must be forms of a single species, depending upon vigour and the conditions under which they grow." Rolfe also called our attention to an obvious fact by saying: "It is not at all like a case of natural hybridization where the parent species are themselves quite distinct."

Fuller (Orch. of Wis. (1933) 65), however, did not agree with Knight that reversal of form occurred in each of the species after transplanting to a different habitat.

He cited several examples supporting his opinion. Sheet 35728 in the Ames Herbarium and an article by Ames tend to support Fuller's claim. The sheet bears a specimen and photograph of a plant of *C.pubescens* which according to Ames (Am. Orch. Soc. Bull. 2 (1933) 28) has been in cultivation for more than fifty years. The plant's identity has apparently remained the same as when it was first transplanted. The plants were growing in partial shade in garden loam which was generally enriched with leaf mold. It is very probable that this habitat was similar to that from which the plant was first taken, thereby affording no opportunity for a possible reversal in form due to response to habitat. Fuller also disagreed with both Knight and Rolfe as to the lack of distinctness of each species. He said: "In Wisconsin, *C.pubescens* must be considered of equal rank with *C.parviflorum* and distinct. Only few intermediate forms have been observed by the author and there is field evidence that these may be hybrids."

Farwell (Twentieth Rept. Mich. Acad. Sci. (1918) 197), following Rydberg in part, said that there were three distinct forms of Yellow Lady's Slipper in Michigan, and that as far as he knew no intermediate forms were to be found. The species which he proposed and their most critical diagnostic characters were:

1. *C.pubescens* var. *Makasin* or *C.Makasin*: Small flowers; sac $\frac{1}{2}$–1 inch long, moccasin-shaped, compression vertical (wider than deep); the staminode linear and obtuse.

2. *C.pubescens* Willd.: Flower similar to the above but with a sac $1\frac{1}{2}$–2 inches long, moccasin-shaped, compression vertical (wider than deep); the staminode oblong and obtuse.

3. *C.parviflorum* Salisb.: Intermediate as to length of sac, sac bulbous or nearly so, slightly compressed lat-

erally, deeper than wide, convex above and below (not so in the others); staminode deltoid and acute.

Farwell was of the opinion that the plant Salisbury described had the deltoid staminode of number three and the small, flat sac of number one. He asserted that no combination of these characters existed as far as he knew. He also implied that Salisbury might have made drawings of dried material of number three and a conventional sac (perhaps number one) was added which resembled *C. Calceolus*.

After stating: "The plants [*C. parviflorum* and *C. pubescens*] closely resemble one another . . . ", Wilson (The Garden 89 (1925) 360) said: ". . . in Mr. Burrage's plants several masses had both kinds [of flowers] intermixed, and this supported the previously recorded opinion that not only are they one and the same species, but that one variety might pass into the other when influenced by different climatic conditions."

A more recent work on North American orchids, that by Morris and Eames (Our Wild Orchids, 1929), has some very interesting notes relative to our yellow Cypripediums. The authors stated that although *C. parviflorum* was a bog plant it was ". . . adaptive and hardy enough to have spread from its native swamp to upland wood and grassy bank, . . .". (p. 8) Stating that "Extremes of the Yellow [Cypripediums] differ so remarkably in form and color that many botanists distinguish three kinds", they concluded, "It seems best to include them all in a single species of very variable habit." (p. 11)

In the original descriptions no measurements whatsoever were given of *C. parviflorum* and *C. pubescens* as to the length and breadth of the various parts of the plants. However, in time, it was found necessary to cite arbitrary measurements in an effort to separate the so-called species. The measurements in general use today

are those proposed for the lip by Ames in *Gray's New Manual of Botany* (ed.7 (1908) 306). For *C.parviflorum*, he specified that the lip was 2–3 cm. long; for var. *pubescens*, that the lip was 3.5–5 cm. long. The question then arises as to where those plants should be placed which possess lips less than 2 cm. long or more than 5 cm. long. There is also the question of where those plants should be placed which possess intermediate characters and have lips between 3 and 3.5 cm. long.

In 1932, Fuller (Rhodora 34: 100) proposed ×*C. Andrewsii* as a hybrid of *C.candidum* Muhl. and *C.parviflorum*. In the same year, Curtis (Rhodora 34: 241) also proposed ×*C. Favillianum* as a hybrid of *C.candidum* and *C.parviflorum* var. *pubescens*. Upon examining specimens of Fuller's hybrid *(Curtis 1072)* and Curtis' hybrid *(Curtis 1123)* in the Ames Herbarium, I find that they approach *C. Calceolus* very closely, especially as to the shape of the staminodes. It is highly probable that these so-called hybrids represent a geographical link between the form *C.pubescens*, more commonly found in the East, and *C.montanum* which is confined to the West. As will be pointed out later, *C.montanum* is probably little more than a color form of *C.Calceolus*. Curtis' conclusive statement (l.c. p. 239) that Fuller ". . . has settled the question as to the possibility of a native cypripedium hybrid" is questionable if not entirely premature.

In 1933, Wherry (Am. Orch. Soc. Bull. 2:14) treated *C. parviflorum* and *C. pubescens* as independent species because, as he said, they ". . . differ in habitat and accordingly in cultural requirements." Wherry's physiological basis for the segregation of species of *Cypripedium* does not seem to be in accord with either Knight or Morris and Eames. As has been previously pointed out, Knight (l.c. p. 93) cited experiments of successful transplantings of both *C.parviflorum* and *C.pubescens* to en-

tirely different habitats from the ones in which they originally grew, and Morris and Eames (l.c. p. 8) said that *C.parviflorum* was so adaptive and hardy that it had spread from its native swamp to upland wood and grassy bank. We do not recall any case where a species exists as such because of its "habitat" or "cultural requirements."

Fernald (Rhodora 28 (1926) 168) separated var. *planipetalum* "from both *C.parviflorum* and *C.parviflorum* var. *pubescens* (Willd.) Knight by its short and comparatively broad, flat, usually purplish petals, by the relatively shorter and broader upper sepal with less acuminate or elongate tip and with rounded rather abruptly narrowed or subcuneate base, and by the cordate staminodium." He made the following observations: "In its broad flat petals *C.parviflorum* var. *planipetalum* strongly suggests the Eurasian *C.Calceolus* L. and such a plate as that of Redouté, *Les Liliacées*, i.t. 19 [*C.Calceolus*] looks almost intermediate between *C. parviflorum* and var. *planipetalum*; and in some Eurasian specimens of *C.Calceolus* the staminodium shows a very strong tendency to be cordate [see Sowerby *English Botany* 9 (1869) t. 1; Keller and Schlechter *Monographie und Iconographie Orchideen Europas*. . . 1 (1927) t. 1, no. 3; H.Correvon *Album des Orchidées de l'Europe*. . . (1899) t. 10; Stein's *Orchideenbuch* (1892) 177, fig. 59]. In both *C.Calceolus* and *C.parviflorum* var. *pubescens*, however, the staminodium is longer-stalked than in true *C.parviflorum* and var. *planipetalum* and the sepals and petals of the Eurasian plant are more consistently purple than in the American series. They are very close, however, and it need not be surprising if, with better knowledge of the variations of the two series, the Eurasian and American plants are eventually treated as one polymorphic circumpolar species." (Professor Ames shares with Fernald this latter viewpoint).

Elsewhere, Fernald (l.c. p. 95), speaking of var. *planipetalum*, said: ". . . the larger specimens are, in their broad flat petals, so like some plates of the European *C. Calceolus* L. that, without examination of the staminodium, one would as quickly place them with the European as with the American species. In the form of its staminodium the plant of the Newfoundland limestones is somewhat different from either, . . . it may well be that *C. Calceolus*, *C. parviflorum* and the plant of unglaciated areas [var. *planipetalum*] of western Newfoundland are geographic phases of one circumpolar type."

Professor Fernald's theory as to the preferable treatment which should be given to North American yellow Cypripediums seems to me to be the most reasonable of the proposals which I find in literature. Therefore, after a thorough examination of many sheets of herbarium material and an evaluation of the literature on the subject, I am led to the conclusion that *Cypripedium Calceolus* L. is a polymorphic boreal species to which our North American yellow Cypripediums should be referred. I cannot, as yet, go so far as Fernald suggests and combine both the Eurasian and American plants into one true species. At best, our plants should be given only a varietal position in which polymorphism should be recognized as a constant tendency. To this end, I propose the name *Cypripedium Calceolus* var. *pubescens* for our North American yellow Cypripediums. I further conclude that future attempts to segregate our yellow Cypripediums into other than the comprehensive var. *pubescens* category should be left to the geneticists. It is apparently not a problem for taxonomists!

Cypripedium Calceolus var. **pubescens** *(Willd.)*
Correll comb. nov.

Cypripedium Calceolus Linnaeus Species Plantarum ed. 1, 2 (1753) 951, in part.
Cypripedium parviflorum Salisbury in Trans. Linn. Soc. 1 (1791) 77, t. 2, fig. 2.
Cypripedium flavescens de Candolle in Redouté Liliacées 1 (1802) t. 20.
Cypripedium Calceolus Linnaeus *sensu* Michaux Flora Boreali-Americana 2 (1803) 161.
Cypripedium pubescens Willdenow Hortus Berolinensis 1 (1804) t. 13.
Cypripedium parviflorum Sims in Bot. Mag. 23 (1806) t. 911, non Salisbury.
Cypripedium luteum Aiton ex Rafinesque Medical Flora 1 (1828) 140, t. 30.
Cypripedium luteum var. *pubescens* (Willd.) Rafinesque Medical Flora 1 (1828) 142.
Cypripedium luteum var. *glabrum* Rafinesque Medical Flora 1 (1828) 142.
Cypripedium luteum var. *grandiflorum* Rafinesque Medical Flora 1 (1828) 142.
Cypripedium luteum var. *parviflorum* (Salisb.) Rafinesque Medical Flora 1 (1828) 142.
Cypripedium luteum var. *maculatum* Rafinesque Medical Flora 1 (1828) 142.
Cypripedium luteum var. *biflorum* Rafinesque Medical Flora 1 (1828) 142.
Cypripedium luteum var. *concolor* Rafinesque Medical Flora 1 (1828) 142.
Cypripedium luteum var. *angustifolium* Rafinesque Medical Flora 1 (1828) 142.
Cypripedium bifidum Rafinesque in Atlantic Journ. 1 (1833) 178.
Cypripedium hirsutum Miller *sensu* Morong in Mem. Torr. Bot. Club 5 (1894) 120—*sensu* Fox in Minn. Bot. Studies Bull. 9 (1895) 442, t. 25.

Cypripedium veganum Cockerell and Barker in Proc. Biol. Soc. Wash. 14 (1901) 178.
Cypripedium parviflorum var. *pubescens* (Willd.) Knight in Rhodora 8 (1906) 93.
Cypripedium hirsutum var. *parviflorum* Rolfe in Orchid Review 15 (1907) 184.
Calceolus parviflorus Nieuwland in Am. Midl. Nat. 3 (1913) 118.
Calceolus hirsutus Nieuwland in Am. Midl. Nat. 3 (1913) 118.
Cypripedium bulbosum var. *flavescens* Farwell in Fifteenth Rept. Mich. Acad. Sci. (1913) 170.
Cypripedium bulbosum var. *parviflorum* Farwell in Fifteenth Rept. Mich. Acad. Sci. (1913) 170.
Cypripedium pubescens var. *Makasin* Farwell in Twentieth Rept. Mich. Acad. Sci. (1918) 198.
Cypripedium Makasin Farwell in Twentieth Rept. Mich. Acad. Sci. (1918) 198, *in textu*.
Cypripedium parviflorum var. *planipetalum* Fernald in Rhodora 28 (1926) 168.
Cypripedium planipetalum Morris & Eames Our Wild Orchids (1929) 8, 11.

Roots coarsely fibrous. Plant 1–7 dm. tall, erect, more or less glandular-pubescent throughout (particularly so at the nodes and on the capsules). Leaves many-nerved and plicate, sheathing at the base, oval, ovate or ovate-lanceolate, acuminate, 5–20 cm. long, 4–10 cm. broad at the middle. Flowers one or two, on long slender peduncles, each subtended by a leaf-like floral bract. Floral bracts ovate-lanceolate, acuminate, 1–10 cm. long, 1–4 cm. broad at the middle. Sepals and petals greenish-yellow to crimson-purple. Dorsal sepal 3–8 cm. long, 1–3.5 cm. broad, ovate to ovate-lanceolate, acuminate-attenuated, often simply undulate. Lateral sepals united almost to the apex, bidentate, 2.5–8 cm. long; lamina

broadly oblong-lanceolate. Petals 4–9 cm. long, narrowly linear-lanceolate, flat or spirally twisted. Lip pouch-shaped, 1.5–6.3 cm. long, dull cream-colored to golden-yellow, rarely approaching white, commonly veined or spotted magenta-purple. Staminode bright yellow, spotted with red-madder-purple, varying from spatulate or oblong-linear with a slightly cordate base to triangular-ovate with a somewhat auricled base and obtuse apex, sometimes concave or conduplicate, supported by a thick fleshy stalk.

Variety *pubescens* differs from the species in its polymorphic tendency, varying in the staminode, in size of the flowers and in coloration of the flowers. It also differs from the species in its geographic distribution, *C. Calceolus* being a Eurasian plant while var. *pubescens* is confined to North America. Flowers of the more northern and intermediate forms of var. *pubescens* approach *C. Calceolus* very closely and are strongly odoriferous as in the species.

Variety *pubescens* is not restricted to any specific habitat. In the North it is commonly found in Arbor Vitae, hemlock, spruce, and tamarack swamps and bogs. Throughout its range it is found in sphagnum bogs, thickets, meadows, pastures, open deciduous woods, rocky dry wooded slopes, low moist woods, and open swamps. The variations found in the plants are probably in part due to their various habitats, as well as to their geographic location within the range of the variety. For example, the flowers of the plants found in Louisiana and Mississippi are much larger, on the average, than those of the plants found in Newfoundland. Variations as to color of the flowers and size of the plants may also be partly attributed to the environment of the plant, such as soil conditions, precipitation, temperature and exposure.

The geographic distribution of var. *pubescens* is from

Quebec and Newfoundland south to South Carolina, Georgia, Alabama, Mississippi and Louisiana; southwest to New Mexico and west to the Yukon, British Columbia and Washington. Its flowering season is from April (in the South) to August (in the extreme North).

It is very probable that further study relating to our North American Cypripediums will result in the reduction of *C. montanum* Dougl. as merely a white form of *C. Calceolus*. J.D.Hooker (Bot. Mag. 119 (1893) t.7319) points out that "*Cypripedium montanum* is the representative in Western America of the common *C.pubescens* of the Eastern States; and is so closely allied to the latter plant that except in its lip being white (not yellow) and its flowers fragrant, there is little to distinguish them." Franchet (Journ. de Bot. 8 (1894) 229) said that *C.parviflorum* and *C.montanum* approached *C.Calceolus* very closely, and Rolfe (Orch. Rev. 25 (1917) 125) said that the general resemblance of *C.montanum* to *C.Calceolus* was "most marked".

I wish to express my gratitude to Professor Oakes Ames, Mr. Charles Schweinfurth and Mr. F. Tracy Hubbard for their helpful suggestions and criticisms during the preparation of this paper.

NOMENCLATORIAL NOTES. IX

BY

CHARLES SCHWEINFURTH

Spiranthes guyanensis *(Lindl.) Cogniaux* in Martius Fl. Bras. 3, pt. 4 (1895) 209, t. 47, fig. 2.

Goodyera guyanensis Lindley Gen. & Sp. Orch. Pl. (1840) 494.

Spiranthes aguacatensis Reichenbach filius in Bonpl. 3 (1855) 214.

Spiranthes Hostmanni Reichenbach filius ex Grisebach Fl. Brit. W. Ind. (1864) 640.

Gyrostachys aguacatensis O. Kuntze Rev. Gen. Pl. 2 (1891) 664.

Gyrostachys Hostmannii O. Kuntze Rev. Gen. Pl. 2 (1891) 664.

Spiranthes Brenesii Schlechter in Fedde Repert. 10 (1912) 481.

Brachystele aguacatensis Schlechter in Beihefte Bot. Centralbl. 37, Abt. 2 (1920) 371.

Brachystele guyanensis Schlechter in Beihefte Bot. Centralbl. 37, Abt. 2 (1920) 373.

Judging from a drawing of the type of *Spiranthes aguacatensis* from the Reichenbach Herbarium at Vienna and from the plate of *Spiranthes guyanensis* above cited, it appears that these concepts are inseparable. Great variability in respect to size and stoutness of plant and length of the raceme is shown by various collections from Central America, at altitudes of 3000 ft. or more, which have been referred to *Spiranthes aguacatensis*. Moreover, a series of specimens (two collections) from Trinidad at a low elevation appear to consist of generally more slender plants with less conspicuous and flaring cauline sheaths than much of the Central American material.

As here comprehended, *Spiranthes guyanensis* ex-

tends from Guatemala to Panama and from Trinidad to British Guiana, Dutch Guiana and French Guiana.

Prescottia oligantha *(Sw.) Lindley* Gen. & Sp. Orch. Pl. (1840) 454.

Cranichis oligantha Swartz Prodr. Veg. Ind. Occ. (1788) 120.

Cranichis micrantha Sprengel Syst. Veg. 3 (1826) 700.

Prescottia myosurus Reichenbach filius ex Grisebach Fl. Brit. W. Ind. (1864) 640.

Prescottia gracilis Schlechter in Fedde Repert. Beihefte 7 (January 1920) 51.

Prescottia panamensis Schlechter in Fedde Repert. 16 (April 1920) 357.

The description of *Prescottia gracilis* together with a habit drawing and floral analysis made under the direction of Rudolf Schlechter shows that it is inseparable from *P. oligantha*.

Prescottia panamensis appears also to be synonymous with *P. oligantha*, the type of the former differing only in being a vegetatively smaller form and having a more densely pubescent disc of the lip.

As at present understood, *Prescottia oligantha* extends from southern Florida and Mexico to Panama and Colombia, from the Bahamas through the West Indies to Granada and a recent collection from Mt. Auyan-Tepui *(G. H. H. Tate 1239)* extends the range to Venezuela.

Other species which appear to be very closely related to *P. oligantha* are the Brazilian *P. densiflora* (Brongn.) Lindl., the Colombian *P. filiformis* Schltr. and the Brazilian *P. viacola* Rodr. all of which differ from it chiefly in having an acute or acuminate lip.

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A SPHENOPSID FROM THE LOWER DEVONIAN OF WYOMING

BY
RICHARD EVANS SCHULTES AND ERLING DORF

Sphondylophyton *Schultes & Dorf gen. nov.*

Herba laxe caespitosa ut videtur, ex axibus simplicibus aliquid flexuosis constans. Axes appendices complanatas, probabiliter rigidas, basi dichotomas, foliosas incurvatas verticillatas ferentes. Verticilli parte terminali (?) congesti, inferne laxiusculi. Fructus ignoti.

Plant apparently loosely caespitose; composed of unbranched, somewhat flexuous axes bearing flat, probably stiff, basally dichotomous leaf-like appendages which are disposed in whorls rather widely spaced except near the tips (?) where the whorls are crowded. Fructifications unknown.

Sphondylophyton hyenioides *Schultes & Dorf sp. nov.*

Herba laxe caespitosa ut videtur. Axes simplices, flexuosi, plus minusve 3 cm. longi (probabiliter imperfecti), 1–2 mm. lati, verticillos ferentes. Verticilli e duabus ad quattuor appendicibus foliosis constant. Appendices complanatae foliosae, basi ramosae, incurvatae, probabiliter rigidae; segmenta truncato-linearia, aequalia, 5–8 mm. longa, plus minusve 1–2 mm. lata. Verticilli regu-

lariter dispositi, inferne inter se 4–6 mm. distantes, partibus apicalibus (?) congesti. Fructus ignoti.

Plant of apparently loosely caespitose habit with unbranched, flexuous axes averaging 3 cm. in length (probably incomplete) and 1–2 mm. in width, bearing whorls of from two to four leaf-like appendages. Leaf-like appendages flat, stiff (?), basally dichotomous, with the two segments equal; segments truncate-linear, 5–8 mm. long and 1–2 mm. in width. Whorls regularly disposed, 4–6 mm. apart, except on the terminal (?) portion of the axes where the whorls are more closely packed and the leaf-like appendages are more or less incurled. Fructifications unknown.

Paleobotanical Collections, Princeton University, No. 24101; Beartooth Butte formation, Lower Devonian, Beartooth Butte, Wyoming.

Geological considerations

The type specimen of this genus and species was collected by Dorf during the summer of 1934 from the Lower Devonian Beartooth Butte formation (6) at Beartooth Butte, Wyoming. The fieldwork in this area was conducted under the auspices of the William Berryman Scott Fund of Princeton University.

The Beartooth Butte formation has been shown (6) to be a local channel-fill deposited in quiet, shallow, non-marine water under estuarine conditions. The lens-shaped deposit is separated from the underlying Bighorn dolomite of Upper Ordovician age by a marked disconformity, and is overlain disconformably by the Middle Devonian Jefferson limestone.

Plant remains were found in the channel-fill in direct association with a large Lower Devonian fauna of ostracoderms, arthrodires, elasmobranchs, eurypterids, and a questionable dipnoan (2,3,13). Five distinct types of plant remains have previously been described from this

locality (4,5). The present form is the sixth. The floral evidence substantiates the Lower Devonian age reference based on the primitive fishes.

The plant fossils, as well as the best preserved fish remains, occur in a massive, mouse-gray, argillaceous limestone, weathering to grayish and pinkish buff. These beds are well exposed in the eastern scarp face of Beartooth Butte between thirty and ninety feet above the base of the deposit.

Botanical considerations

Sphondylophyton hyenioides apparently was a loosely tufted plant growing in a frequently flooded habitat. It is probable that all of the disconnected axes preserved on specimen No. 24101 (Fig. I) belong to the same plant. Their appearance suggests that they might have arisen from a single basal portion and were more or less flattened out centrifugally in several directions before or during preservation. They may have rotted off and fallen into the wet mud at the exact place of growth. Since no fragments of the axes of *Sphondylophyton hyenioides* have been found on any other specimens collected from the fossiliferous horizon, it argues that the fragments associated so closely together on specimen No. 24101 did not float in from some other location, but were probably attached to the same base and were preserved essentially in place.

The axes appear to be unbranched, and, although the length of the shoots may have been somewhat longer than in the fossil, it is probably true that sufficient lengths are preserved to warrant the statement that the plant did not branch above the base. It is certain from the specimen that branching was rare if it did occur.

The axes appear also to have been capable of standing more or less erect and of supporting the relatively large

EXPLANATION OF THE ILLUSTRATION

FIGURE I. SPHONDYLOPHYTON HYENIOIDES *Schultes & Dorf gen. et sp. nov.* Heliotype reproduction of a photograph of the type specimen. Three fifths natural size. Paleobotanical Collections, Princeton University, No. 24101; Beartooth Butte formation, Beartooth Butte, Wyoming, U. S. A. Lower Devonian.

024101

whorls of foliar appendages. It has not been possible to find traces of internal structure by means of peel and maceration techniques. Material for anatomical study is extremely limited since only one specimen of this plant is known. It has been impossible, even under relatively high magnifications, to find a definite ridge which might have been a vascular strand. The aspect of the entire plant, however, suggests, by comparison with other known vascular plant-fossils of similar nature, that it must have been vascular in structure.

An important aspect of *Sphondylophyton hyenioides* is the presence of leaf-like appendages or foliar organs in whorls. The verticillation is more regular than in *Hyenia sphenophylloides* Nathorst (7,12) or than in *Hyenia elegans* Kräusel & Weyland (9,10) of the Middle Devonian of Norway, Germany, and other parts of Europe. The whorls in *Sphondylophyton* are regularly spaced (Fig. 11), on the lower fragments of axes averaging four to six millimeters apart; on the several shorter pieces, the whorls are placed about one to three millimeters apart. The axes bearing these crowded whorls are further distinguished by having the foliar organs curled into a bud-like mass. Consequently it is probably safe to assume that these portions are terminal.

The form of the foliar organs is also of extreme interest. They were apparently flat, somewhat coriaceous, and possibly more or less stiff. Each appendage of the whorl is basally dichotomous into two equal or subequal truncate-linear segments. The "terminal" axes, however, possess foliar organs of a different shape. The segments of the appendages are slightly incurved, pointed and curled together into bud-like masses. Whether or not any significance attaches to this difference is still a question.

That the lower portion of the axes was probably naked

(lacking whorls of appendages) is suggested by the presence of a "leaf-less" axis measuring 1.5 centimeters in length (Fig. II). This may be the basal portion of one of the closely adjacent "leafy" axes.

Unfortunately, in the material at present available, no fertile parts are recognizable. Consequently, the solution of the extremely important problem of the form and placement of the sporangia of *Sphondylophyton hyenioides* must await the discovery of further material. It is not impossible that the several portions which appear to be terminal (with closely set whorls) may actually be sporangiophoric in nature.

The close resemblance of the axes of *Sphondylophyton hyenioides* to certain algae must be considered. In megascopic aspect, this plant does not seem to be remote from some of the whorled algae. This may be significant in placing *Sphondylophyton* very near the ancestral algal type in the origin of the sphenopsids. The whorled condition is not uncommon among the algae, especially among the grass-green algae, the *Chlorophyceae*. The microscopic *Algites Cranii* Kidston & Lang (8) (*Characeae* ?) of the Lower Devonian of Rhynie, Scotland, possesses a verticillately branched axis. Among the freshwater algae of the present, the *Characeae* (species of *Chara* and *Nitella*) are whorled. Arber (1) points out that *Crouania* and *Lomentaria* resemble the sphenopsid habit, but are, of course, marine forms.

It is suggested, however, that *Sphondylophyton hyenioides* represents a land plant of the early sphenopsid complex and not an alga. The reasons for this opinion may be stated as follows: 1, *Sphondylophyton* grew in association with a typically terrestrial flora; 2, the habitat was non-marine, occasionally flooded by fresh water, and no living non-marine verticillate alga nor any known whorled fossil algal form is so large as *Sphondylophyton*;

3, the plant remains are more heavily carbonized than appears to be possible for a member of the family *Characeae* and probably for any alga.

Until more sphenopsids are discovered in Lower Devonian or Upper Silurian rocks, the forms most closely related to *Sphondylophyton* can be inferred only from megascopic characteristics. It may be said, however, that *Sphondylophyton hyenioides* is best interpreted as an early member of the *Sphenopsida.*

As the specific name of the plant implies, *Sphondylophyton* bears a striking resemblance to *Hyenia sphenophylloides* Nathorst (7,12) and to *Hyenia elegans* Kräusel & Weyland (9,10) of the Middle Devonian, hitherto the earliest known undoubted sphenopsids. The general tufted habit of the plant and the verticillation of the foliar organs correspond rather closely with that of the two species of *Hyenia.* There are, however, marked differences: *Sphondylophyton* has no longitudinal striations on the axes, has foliar organs once (basally) instead of twice dichotomous as in *Hyenia*, and has, in general, a more thalloid habit than *Hyenia. Sphondylophyton* is much more alga-like in appearance than *Hyenia.* For these reasons, and because of the lack of fertile material, the Wyoming sphenopsid deserves generic rank.

Climaciophyton trifoliatum Steinmann & Elberskirch (11,14) is a sphenopsid of the Lower Devonian of Germany. Until the discovery of *Sphondylophyton*, *Climaciophyton* was the only known Lower Devonian plant of possible articulate affinity. It is curious, however, that beyond the verticillation, *Climaciophyton* bears no close resemblance to *Sphondylophyton*, and it is probable that the relationship between the two forms is distant. The leaf-like appendages of *Climaciophyton* are more or less obtusely triangular with a number of nerves. Moreover, *Sphondylophyton* is a much larger plant than *Climacio-*

EXPLANATION OF THE ILLUSTRATION

FIGURE II. SPHONDYLOPHYTON HYENIOIDES *Schultes & Dorf gen. et sp. nov.* Heliotype reproduction of a photograph of a portion of the type specimen, enlarged three times. The color of the rock matrix is a dull pinkish-buff. The photographs for Figures I and II were taken through a red filter with the specimen submerged in xylol. Paleobotanical Collections, Princeton University, No. 24101; Beartooth Butte formation, Beartooth Butte, Wyoming, U.S.A. Lower Devonian.

phyton. The presence of these two articulate elements in the Lower Devonian floras projects the history of the *Sphenopsida* much farther back than was formerly the case, and, since they occur on two different continents, the pre-Devonian history of the *Sphenopsida* may have been as long as that of the parallel groups of the Devonian—the *Psilopsida* and the *Lycopsida*.

Sphondylophyton hyenioides occurs as an element of a typical Lower Devonian "*Psilophyton*-flora". The Beartooth Butte flora of Wyoming (4, 5) is the only known representative of this simple and primitive association of plants in the western part of North America. Included in the flora are such forms as *Hostimella sp.*, *Psilophyton wyomingense* Dorf, *Bucheria ovata* Dorf, and *Bröggeria strobiliformis* Dorf. The discovery of *Sphondylophyton hyenioides* together with these Devonian psilopsids and other simple plants is the first evidence of definitely sphenopsidal elements in the "*Psilophyton*-floras" of North America, and the second in the Lower Devonian of the world.

Summary

Sphondylophyton hyenioides Schultes & Dorf of the Lower Devonian of Wyoming is a plant of tufted habit, the axes bearing whorls of relatively large, dichotomous, thalloid foliar appendages. It is the first actual evidence of the sphenopsids in the "*Psilophyton*-floras" of the Lower Devonian of North America and the second in the floras of that age in the entire world. In its habit, the plant is much nearer an ancestral algal form than is any previously known sphenopsid.

BIBLIOGRAPHY

1. Arber, A.E.Newell "Devonian floras" Cambridge, 1921.
2. Bryant, W.L. "The fish fauna of Beartooth Butte, Wyoming." Part I. Proc. Amer. Phil. Soc., vol. lxxii, no. 5, pp. 285-314, 1933.
3. Bryant, W.L. "The fish fauna of Beartooth Butte, Wyoming." Parts II and III, Proc. Amer. Phil. Soc., vol. lxxiii, no. 3, pp. 127-167, 1934.
4. Dorf, Erling "A new occurrence of the oldest known terrestrial vegetation from Beartooth Butte, Wyoming." Bot. Gaz., vol. xcv, no. 2, pp. 240-256, December, 1933.
5. Dorf, Erling "Lower Devonian flora from Beartooth Butte, Wyoming." Bull. Geol. Soc. Amer., vol. xlv, pp. 425-440, June 30, 1934.
6. Dorf, Erling "Stratigraphy and paleontology of a new Devonian formation at Beartooth Butte, Wyoming." Journ. Geol., vol. xlii, no. 7, pp. 720-737, 1934.
7. Hóeg, Ove Arbo "Notes on the Devonian flora of western Norway." Kgl. Norske Vidensk. Selsk. Skrift., no. 6, 1931.
8. Kidston, R.& Lang, W.H. "On old red sandstone plants showing structure, from the Rhynie chert bed, Aberdeenshire. Part V. The *Thallophyta* occurring in the peat-bed; the succession of the plants throughout a vertical section of the bed, and the conditions of accumulation and preservation of the deposit." Trans. Roy. Soc. Edinburgh, vol. lii, pt. 4, no. 33, 1921.
9. Kräusel, R. and Weyland, H. "Beiträge zur Kenntnis der Devonflora II." Abh. Senckenb. Naturforsch. Gesell., vol. xl, pt. 2, pp. 115-155, 1926.
10. Kräusel, R. and Weyland, H. "Beiträge zur Kenntnis der Devonflora III." Abh. Senckenb. Naturforsch. Gesell., vol. xli, pt. 7, pp. 315-360, 1929.
11. Kräusel, R. and Weyland, H. "Die Flora des deutschen Unterdevons." Abh. Preuss. Geol. Landesanst., n.f., pt. 131, 1930.
12. Nathorst, A.G. "Zur Devonflora des westlichen Norwegens." Bergens Museums Aarbok, 1914-1915, no. 9, pp. 12-34, Bergen, 1915.
13. Ruedemann, R. Proc. Amer. Phil. Soc., vol. lxxv, no. 2, p. 129, 1935.
14. Steinmann, G. and Elberskirch, W. "Neue bemerkenswerte Funde im ältesten Unterdevon des Wahnbachtales bei Siegburg." Jahrb. Köngl. Preuss. geol. Landesanst., 1929.

A NEW TRANSFER METHOD FOR STUDYING FOSSIL PLANTS

BY

WILLIAM C. DARRAH

THE MICROSCOPIC STUDY of fossil plants has made many great advances since Henry Witham published his histological investigation of several fossils from Great Britain in 1833. His study comprised notes on twelve species prepared by the thin section method, by which translucent sections could be ground from slices sawn from petrified specimens. This method has been in general use for more than a century.

More recently translucent sections have been prepared by the peel method. A specimen is etched with a suitable acid in order to dissolve the inorganic matrix and expose the carbonized portions of the preserved plant structures. Following this step, a solution of nitrocellulose in butyl acetate is poured over the etched surface. After the nitrocellulose has dried it can be peeled off, pulling with it a nearly perfect replica of the preserved structure.

The thin section can be subjected to magnifications from 100 to 250 times, but the thickness of the glass slide, the thin section of the fossil, and the cover glass collectively prevent the use of higher magnifications—at least with transmitted light. A ground section is almost always more than one cell thick.

The nitrocellulose peel, in contrast, may be so prepared that the thickness of fossil is from one to three micra, frequently much less than one cell in thickness. However, the thickness of the nitrocellulose is relatively great. Even so, magnifications greater than 500 times are usually permitted, and occasionally excellent photographs can be made at magnifications of 1200 times.

One of the great problems attendant upon the study of fossil plants with structure preserved is the difficulty involved in using high magnifications. The use of oil immersion objectives has hitherto been impractical.

Several months ago, my colleague, Doctor A. Orville Dahl suggested the possibility of preparing a peel and subsequently freeing the occluded plant structures by redissolving the nitrocellulose. With this purpose in mind, I tried a number of procedures on various types of fructifications with encouraging results.

A peel containing spores or pollen grains is carefully cropped with scissors and the selected portion is set aside for the transfer of the spores or pollen. Then a glass slide is thoroughly cleaned and moistened with a droplet of albumen (egg-white). The slide is air dried in a dust-free place for twenty minutes and then the peel is impressed in the albumen. The glass slide with the peel adhering to it is placed in a container of butyl acetate and is permitted to stand until all of the nitrocellulose has been dissolved. This is usually accomplished in three or four hours. When this transfer of the spore or pollen grain has taken place, that is, the body is now imbedded in the albumen instead of the nitrocellulose, the slide is removed from the solvent and is gently dipped into butyl alcohol. The albumen can then be completely dehydrated with absolute ethyl alcohol, and the fossil quickly covered with balsam and a cover glass. Such a permanent mount can be studied in the same manner as a similar preparation of parts of extant plants.

With this new tool, paleobotanists may be able to find gametophytes among those extinct ferns which are supposed to have been endosporal in development, and to investigate the male gametophytes of the early seed plants.

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PLANTAE MEXICANAE II

BY
RICHARD EVANS SCHULTES

THE IDENTIFICATION OF TEONANACATL, A NARCOTIC BASIDIOMYCETE OF THE AZTECS

I. Introduction

Investigations dealing with the vegetable narcotics, intoxicants, and poisons used by primitive peoples comprise studies which involve some of the most fundamental culture-traits. The narcotic plants of the New World especially are attracting popular attention while stimulating scientific interest. In this connection, a large ethnobotanical and ethnopharmacological literature is being developed. A recent anthropological study (13) has briefly summarized some of the information concerning the primitive uses of a number of narcotics and has emphasized the importance to theoretical anthropology of correctly identified and thoroughly investigated ethnobotanical material. Indeed, this summary and other recent papers have clearly emphasized the need, as well as the desirability, of further botanical and ethnological investigations of plant narcotics, their uses, and their significance.

The plant narcotics of Mexico are of unique interest because careful records of their uses at the time of the Spanish Conquest are often available. It is possible, therefore, to compare their past uses with the uses made of

them at the present time. Fundamental to any study of this kind, however, is a thorough botanical investigation of plant uses among modern Mexican Indians and a critical examination of the earlier ethnobotanical records.

Botanical and anthropological literature contains many references to a mushroom which has been employed as a narcotic by some of the Indians of Mexico. The Aztecs and the Chichimecas were the earliest recorded users of these mushrooms which they called *teonanacatl*. For several centuries, however, the identity of teonanacatl has remained obscure. Recurring references to it have mystified biological and anthropological investigators, inasmuch as careful search had failed to reveal any Mexican fungus possessing properties used to induce a narcosis. It has been suggested that the reports which associate teonanacatl with a mushroom are misleading or erroneous, although the sources from which they come are in other respects dependable and credible.

Both from a botanical and ethnological point of view a knowledge of the identity of teonanacatl should prove of value. Furthermore, the correct identification of this narcotic plant is rendered desirable and necessary because an obvious misidentification has gained wide acceptance among botanists and anthropologists.

II. The identification of teonanacatl

In the summer of 1938, I began ethnobotanical investigations among the Mazatec Indians of northeastern Oaxaca and learned that a mushroom, subsequently identified as *Paneolus campanulatus* L. var. *sphinctrinus* (Fr.) Bresadola[1], was being used as a narcotic.

[1]I wish to express my thanks to Dr. David Linder of the Farlow Herbarium, Harvard University, who corroborated field identifications and rendered further taxonomic assistance.

In 1937, Dr. Blas Pablo Reko, my co-collector in Oaxaca, sent me several pieces of a mushroom which he found used as a narcotic by the Otomi Indians of Puebla and adjacent regions. Unfortunately, these specimens were poorly preserved, but they are referable to the genus *Paneolus* and belong to a related if not to the same species as those which were collected in Oaxaca.

Johnson (9) reports that three kinds of mushrooms are used by Mazatec *brujos* (witch-doctors); the names of these he reports as *steyí* and *tsami-yé*, *tsamikíshu*, and *tsamikindí*. Although botanical identifications were not made, it is probable that these are all species of *Paneolus*, possibly *P. campanulatus* var. *sphinctrinus* and its close allies *P. campanulatus* L. and *P. papilionaceus* Fr.

When identifiable specimens of the fungus had been secured and when ample information regarding its use was obtained, it became evident that *Paneolus campanulatus* var. *sphinctrinus* was the teonanacatl of the ancient Aztecs.

Paneolus campanulatus *Linnaeus* var. **sphinctrinus** (*Fries*) *Bresadola* Iconographia Mycologica (1931) t. 894.

Agaricus (Paneolus) sphinctrinus Fries Epicrisis systematis mycologici seu synopsis Hymenomycetum (1836-1838) 235-236.

Bresadola's description is:

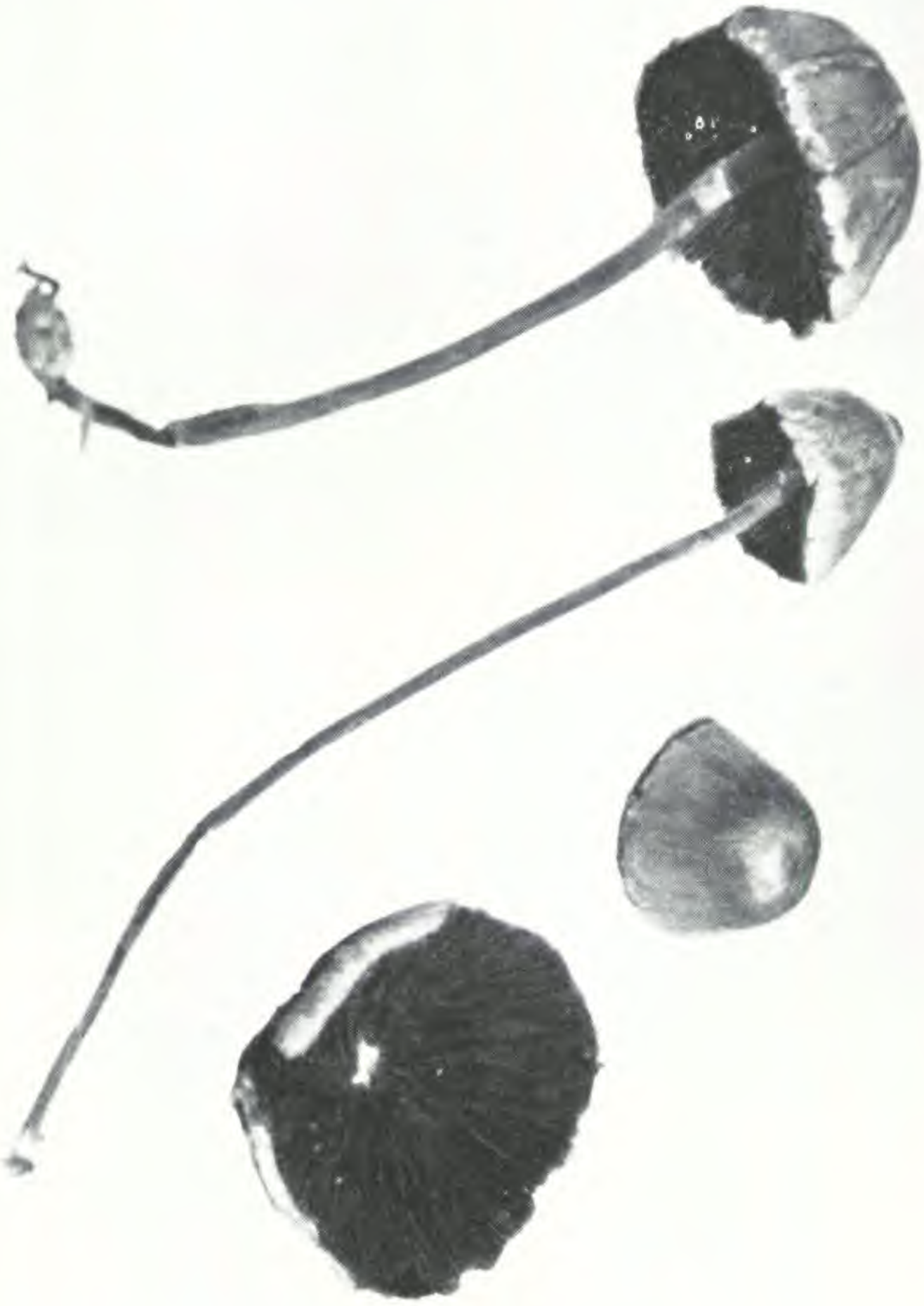
"Pileus carnosulus, parabolicus, obtuse acuminatus, opacus, levis, udus, glaber, fuligineo-nigricans, sicco olivaceo-lividus vel fuligineus, subsericeus, $1\frac{1}{2}$—$2\frac{1}{2}$ cm. altus latusque, velo albo primitus dentato-appendiculatus; lamellae subconfertae, postice adnatae, cinereo-nigricantes, atro-maculatae, acie concolores; stipes fistulosus, cylindraceo-filiformis, aequalis, fuligineo-griseus, apice albo-

pruinosus, deorsum rufescens, basi albo-floccosus, 5–8 cm. longus, $1\frac{1}{2}$–$2\frac{1}{2}$ mm. crassus; caro tenuis, dilute umbrina, inodora et insapora; sporae sublimoniformes, fusco-atrae, opacae, leves, 14–18—9–12μ; basidia clavato-capitata, 25–30—12–14μ; cellulae aciei lamellarum cylindraceae, 50–60—6–7μ.''

MEXICO: in boggy spots in meadows during heavy rains, Huautla de Jiménez, Oaxaca, July 27, 1938, *Richard Evans Schultes & Blas Pablo Reko 231*, Harvard Botanical Museum Collections (Economic Botany) No. 5548.

COMMON NAMES: Aztec—*nanacatl* (''mushroom''), *teonanacatl* (''sacred mushroom''), *quauhtlananacatl* (''wild mushroom''); Mazatec—*t-ha-na-sä* (meaning unknown), *she-to* (''pasture mushroom''), *to-shka* (''intoxicating mushroom''); Otomi—unknown.

The Oaxacan specimens, upon which this identification of teonanacatl is based, agree closely with the variety of *Paneolus campanulatus* L. which was made by the reduction of *Agaricus (Paneolus) sphinctrinus* Fr. to varietal rank. They lack, however, the pronounced appendiculate margin which is figured by Bresadola (3). The mushrooms are small, never more than ten centimeters in height. The dark brown stipe is terete and very slender and measures from one to two millimeters in diameter; the dark color of the stipe serves to separate this species from the closely related *Paneolus papilionaceus* Fr. The pileus, three centimeters in diameter and one half centimeter in height, is usually somewhat conical (perfectly hemispherical in a few specimens), slightly cuspidate, and of a light yellowish-brown color. The gills are spotted and are dark brownish-black. The spores, varying from 12–15$\times$7.5–8.3 μ, are black. This mushroom and its close relatives *Paneolus campanulatus* L. and *P.papilionaceus* Fr. are exceedingly widespread, occurring on all the major continents.



PANEOLUS CAMPANULATUS *L.*
var. SPHINCTRINUS *(Fr.) Bresadola*

Among the Mazatec Indians, *Paneolus campanulatus* var. *sphinctrinus* is regularly used by some members of the tribe as a narcotic. The plant does not appear to be common in the Mazatec country. It grows in pastures and open fields during the rainy season from June to September. Those who use it search for it eagerly, gathering and drying it for future use. Because the mushroom is regarded as being semi-sacred, it is difficult to purchase specimens. They are usually presented as a gift.

There are among the Mazatecs professional divinators who earn a livelihood by endeavoring through mushroom intoxication to locate stolen property, discover secrets, and give advice. The narcotic is taken to induce a semi-conscious state accompanied by a mild delirium. The incoherent utterances made during intoxication are interpreted as prophetic or admonitory. This, curiously enough, parallels the use of ololiuqui (the seeds of *Rivea corymbosa* (L.) Hall. f.),a convolvulaceous narcotic which is still used in parts of Oaxaca, and of various species of *Datura* which are very widely employed to induce a delirium that is thought to assist in divination and witchcraft.

The professional Mazatec divinators evidently store large numbers of these mushrooms for use throughout the year, for the doses said to be required for intoxication are large. It was impossible to learn whether these divinators practice their art exclusively with *Paneolus* or whether they are general *curanderos* (herb-doctors) as well. They are said to age rapidly, probably because of frequent ingestion of the slightly poisonous *Paneolus;* at the age of thirty-five, senility is apparent.

It was impossible to ascertain the extent of this profession, but the use of the narcotic is by no means confined to the divinators. Any individual may eat the mushrooms. That the consumption of the fungus is large

is borne out by the fact that it was with difficulty that we were able to secure two dozen specimens. Johnson (9) has learned that certain "narcotic mushrooms" are of importance in Mazatec witchcraft, and it is probable that these also are referable to the genus *Paneolus*.

The doses which the Indians employ vary with the size and age of the individual. Usually fifteen mushrooms are sufficient to induce the desired effect, but larger doses are reported. Overdoses of fifty or sixty mushrooms result in poisoning, while continued use of excessive quantities is said to produce permanent insanity. Whether or not this is true could not be ascertained.

According to Indian descriptions, the intoxication lasts about three hours. Shortly after ingestion of the mushrooms, a general feeling of exhilaration and well-being is experienced. This state of exhilaration is followed within an hour by hilarity, incoherent talking, and later, is accompanied by fantastic visions in brilliant colors, similar to the visions so characteristic of peyote-intoxication (*Lophophora Williamsii* (Lem.) Coulter).

Paneolus is known to be slightly poisonous and narcotic. With the exception of Mexican Indians, I am aware of no primitive peoples who take advantage of the properties of this genus for intoxication. The effects of *Paneolus* have been studied (5,6,12) and the symptoms of the intoxication are similar to those of alcoholic-intoxication. Ford (6) has divided mushroom-poisoning into five categories: the choleriform type (*Amanita phalloides* (Fr.) Quél.); the nerve-affecting type in which occur convulsions and coma often resulting in death, (*Amanita muscaria* (L.) Pers. and other muscarine-containing forms); the gastro-intestinal type which is seldom fatal; the blood-dissolving type; and the cerebral type. Paneolus-intoxication belongs to the last category of poisonings. It is characterized by exhilaration, fantastic visual

hallucinations, a feeling of ease and well-being, muscular incoördination, drowsiness, a staggering gait or difficulty in walking, emotional excesses, laughter, incoherent and uncontrolled speech, and mydriasis. The effects following ingestion are always of short duration.

It is of significance that the description of Paneolus-intoxication by Douglas (5) and Krieger (12) is practically identical with that given by the Mazatec Indians and with descriptions found in early Spanish accounts of the use of teonanacatl among the Aztecs.

III. Historical background of teonanacatl

The first attempt to identify *teonanacatl* botanically was made in 1915, when Safford (18,19) published his conclusions that the so-called "mushroom" was, in reality, a part of the cactus *Lophophora Williamsii* (Lem.) Coulter and, notwithstanding the numerous independent reports and descriptions in literature, was not a fungus.

After a careful study of herbarium specimens, Safford failed to find a Mexican mushroom with narcotic or intoxicating properties. Safford (19) states: "Three centuries of investigation have failed to reveal an endemic fungus used as an intoxicant in Mexico, nor is such a fungus mentioned either in works on mycology or pharmacography; yet the belief prevails even now that there is a narcotic Mexican fungus...". This induced him to search among other plants and plant products for something which the early writers or the Indians might have confused with a dried fungus. He believed that the dried, brown, discoidal head (mescal button) of the spineless peyote-cactus (*Lophophora Williamsii*) resembled "a dried mushroom so remarkably that, at first glance, it will even deceive a mycologist" (19). Peyote was used by the Aztecs as a religious narcotic during this same period, and the symptoms of intoxication were described as some-

what similar, especially in the production of fantastic visual hallucinations. It should be emphasized, however, that there is actually little similarity in appearance between mescal buttons and the dried pilei of *Basidiomycetes*: the shrivelled crowns of *Lophophora Williamsii* assume the drab color of a dried mushroom, it is true, but a heavy cushion of closely placed areolate tufts of silky hairs densely clothes the upper surface of the dried cactus-head, while the fibrovascular region is clearly visible on the lower surface. It seems improbable, therefore, that either the historians or the Indians were deceived by a superficial color-resemblance.

However, Safford (18,19) based his conclusions: 1) on the apparent absence from Mexico of narcotic or intoxicating mushrooms and 2) on the supposed similarity between mescal buttons and dried mushrooms. He concluded that the Aztec Indians, who gathered for use both *peyote* and *teonanacatl* and whose botanical knowledge and powers of observation were keen, had failed to recognize the hard, wrinkled, brown mescal buttons as a part of the soft, succulent, green peyote-plant of the desert. The former, he assumed, they called *teonanacatl*, the latter *peiotl*.

Furthermore, Safford had at his command a number of the detailed descriptions of the early writers on Mexico. He failed to see in these, however, any overwhelming negation of his identification of *teonanacatl*. As LaBarre (14) aptly states: "Safford identifies the two by a somewhat casual use of his evidence and mystifies himself with the consistent contradiction offered by all the early Spanish writers to his assumption. He composes the contradiction by assuming that the Aztecs did not recognize the dried, discoidal button as the same plant as the green cactus; despite overwhelming etymological evidence, he

supposes they called the former 'teonanacatl' and the latter 'peyotl' ".

Much of the work done by Safford in the identification of important and interesting economic plants of ancient Mexico was brilliant. It is not surprising, therefore, that workers were inclined to accept his treatment of teonanacatl. Safford's erroneous identification unfortunately was generally accepted and has become rather firmly established in both botanical and anthropological literature.

Until recently, no published objections were raised against Safford's identification. From the first, however, Doctor Blas P. Reko maintained that peyote and teonanacatl were not identical. Reko has carried out rather extensive botanical collecting and anthropological investigations of several kinds in Mexico for more than a quarter of a century. From his own experience and from a belief in the dependability of the early reports, he insisted on the presence of a narcotic mushroom among Mexican Indians. Thus, in 1919, he stated (15) that nanacatl was "div. géneros de hongos, especialmente un hongo negro que crece sobre estiércol y produce efectos narcóticos," and in 1923, he wrote as follows in a letter[2]: ". . . I see in your description of *Lophophora* that Dr. Safford believes this plant to be the 'teonanacatl' of Sahagun which is surely wrong. It is actually, as Sahagun states, a fungus which grows on dung-heaps and which is still used under the same old name by the Indians of the Sierra Jaurez in Oaxaca in their religious feasts . . .".

[2]Letter: B.P.Reko, Guadalajara, Mexico, to J.N.Rose, United States National Museum, Washington, D. C., July 18, 1923; herbarium sheet No. 1745713, United States National Herbarium, Washington, D.C.

The first published objection to Safford's identification appeared in 1936 (17): "Dem [the Safford identification] muss widersprochen werden. Die Nanacates sind Giftpilze, die mit Peyote nichts zu tun haben. Seit alten Zeiten ist es bekannt, dass ihr Genuss Rauschzustände, Extasen, und Geistesstörungen hervorruft, aber trotz ihrer Gefährlichkeit hat man sie überall, wo sie vorkommen, wegen ihrer berauschenden Eigenschaften bis auf den heutigen Tag geschätzt". V. A. Reko (17) suggests, but without corroboration or evidence, that nanacatl might be a species of *Amanita*. This refutation of Safford's identification, however, is important inasmuch as it once more centered attention on the problem. In 1937 and in 1938, I (23,24) summarized the evidence against the identity of peyote and teonanacatl, and in 1938, La Barre (13) also indicated his doubts of Safford's identification.

Fray Bernardino de Sahagun (c. 1499-1590) was the first European to record the use of teonanacatl as a narcotic. There are several distinct references to this plant in his *Historia de las cosas de Nueva España* (20). One of these references, in a general consideration of useful plants, states that:

> . . . they [the Chichimecas] possessed a great knowledge of plants and roots, and they were acquainted with properties and virtues of them; these same people were the first to discover and use the root which they called *peiotl*, and those who are accustomed to eat and drink them used them in place of wine; and they did the same with those which they call *nanacatl*, which are harmful mushrooms which intoxicate in the same way as wine . . .

A more detailed report of nanacatl is to be found in a chapter devoted to the consideration of narcotic and intoxicating plants:

> There are some small mushrooms in that region which are called *teonanacatl*; these grow under the grass (hay) of the fields and pas-

tures. They are round, having a rather high stipe, slender and terete. When eaten, they have a bad taste, hurting the throat, and they cause intoxication. They are medicinal for fevers and for rheumatism. Only two or three need to be eaten. Those who eat them see visions and feel a faintness of the heart. And they provoke to lust those who eat a number, or even a few, of them.

In the first of these excerpts, Sahagun clearly distinguished between "the root which they call *peiotl*" and "*nanacatl*, which are harmful mushrooms." Likewise in his chapter on narcotic plants from which the second excerpt is taken, Sahagun discussed the "small mushrooms . . . which are called *teonanacatl*" and in another paragraph recognized *peiotl* as a distinct plant:

There is another herb like the earth-tunas which is called *peiotl*. It is white and grows in the north. Those who eat it see terrifying and amusing visions. The intoxication persists for two or three days and then stops . . .

In a third reference to the mushrooms, Sahagun explained the intoxication in great detail:

The first thing which they ate at the gathering was small, black mushrooms which they called *nanacatl*. These are intoxicating and cause visions to be seen and even provoke sensuousness. They ate these [mushrooms] before dawn, and they also drank chocolate before daylight. They ate these little mushrooms with honey, and when they began to be excited by them, they began to dance, some singing, others weeping, for they were already intoxicated by the mushrooms. Some did not want to sing but sat down in their quarters and remained there as if in a meditative mood. Some saw themselves dying in a vision and wept; others saw themselves being eaten by a wild beast; others imagined that they were capturing prisoners in battle, that they were rich, that they possessed many slaves, that they had committed adultery and were to have their heads crushed for the offense, that they were guilty of a theft for which they were to be killed, and many other visions which they saw. When the intoxication from the little mushrooms had passed, they talked over among themselves the visions which they had seen.

From Sahagun's three references, it is obvious that the root-word *nanacatl* meant "mushroom." *Teonana-*

catl probably was the correct word for the narcotic species, and *nanacatl* served as a more general term. This more general use is found in still another one of Sahagun's botanical references to mushrooms:

> The cone-shaped mushrooms (*nanacatl*) *genus campos agrorum* in the mountains are good to eat. They are cooked for this purpose; if they are eaten raw or poorly cooked, they produce vomiting or diarrhea, and they may kill.

Further evidence of the meaning of *nanacatl* is found in the various combinations which were made by adding prefixes denoting the color, habitat, or attributes of the plant. Hernandez (8) describes the narcotic mushroom under the heading: "De nanacatl seu Fungorum genere." He considered teonanacatl as *teyhuinti* or "intoxicating", distinguishing from it several other types of mushrooms: *iztacnanacame* (white mushrooms), *tlapalnanacame* (reddish mushrooms), and *chimalnanacame* (yellow-orbicular mushrooms).

Jourdanet and Siméon (21) define *teonanacatl* as follows: "(*Teonanacatl*) c'est à dire: champignon dangéreux. La terme générique est *nanacatl*, qui se met en composition avec d'autres mots pour désigner les diverses espèces de champignons."

Siméon (26) analyzes several words with *nanacatl* as a root and clearly points out the meaning of the term:

> "*Nanacatl* Champignon; *quauhtla-nanacatl*, champignon des bois; au fig. *nanacatl nicte-ittitinemi* (Olm.), rendre quelqu'un pervers, lui donner de mauvais conseils. En comp.: *nonanac* ou *nonanacauh* (Olm.), mon champignon. R. *nacatl*?
>
> "*Nacatl* Chair, viande; . . . *nonac*, ma viande, la chair que je mange.
>
> "*Teonanacatl* Espèce de petit champignon qui a mauvais goût, enivre, et cause des hallucinations; il est médicinal contre les fièvres et la goutte (Sah.) RR. *teotl*, *nanacatl*.
>
> "*Teyhuinti* Qui enivre quelqu'un, enivrant; *teyhuinti nanacatl*, champignon enivrant."

An additional piece of evidence may be found in the use of the word *nanacatl* in modern Mexico. In provision markets of Mexico, mushrooms in general are called *nacatl* (17).

Serna (25) recorded a very complete description of teonanacatl and its use as a narcotic and clearly distinguished it from peyote:

> And it so happened that an Indian had come . . . bringing some of the colored mushrooms which are gathered in the hills, and, with these, he had performed a great idolatry. But before explaining this [idolatry], I wish to explain the nature of the said mushrooms which, in the Mexican language, are called *quatlannamacatl* . . . these mushrooms were small and yellowish, and to collect them the priests and old men, appointed as ministers for these impostures, went to the hills and remained almost the whole night in sermonizing and in superstitious praying. At dawn, when a certain little breeze which they know began to blow, they would gather them [the mushrooms], attributing to them deity. They have the same effects as ololiuqui and peyote, for when they are eaten or drunk, they intoxicate, depriving those who partake of them of their senses and making them believe a thousand absurdities.

Benvento in Kingsborough (10) reports the use of mushrooms for intoxication:

> They had another kind of intoxication. . . which was induced by small toadstools or mushrooms . . . which are eaten raw. Because of the bitter taste of these mushrooms, they drink after them or eat with them a little honey after which they shortly see a thousand visions, especially snakes. They went raving mad, and they ran about the streets wildly . . . In their language they called these mushrooms *teunamacatlth*, a word which means "bread of the gods . . .".

Basing his statement on the etymology proposed by Siméon (21,25), LaBarre (14) points out that Benvento's etymology is wrong. The belief that *teonanacatl* means "bread of the gods" or "flesh of the gods" is widespread. Thus, in an unpublished manuscript, V. A. Reko (16) applies the meaning of "divine food of a soft or fleshy nature" to *teonanacatl.* Safford (18, 19) consist-

ently used the expression "flesh of the gods." Bancroft (1), in speaking of the intoxicants of the Nahuatls, wrote: "Among the ingredients used to make their drinks more intoxicating, the most powerful was the *teonanacatl*, 'flesh of the gods', a kind of mushroom which excited the passions and caused the partaker to see snakes and divers other visions."

There are numerous less explicit references to the use of mushrooms for intoxication in Mexico. These have no common names or descriptions which might serve to identify the plant, but it is probable that some of the references concern the same species of *Paneolus* which has been identified as teonanacatl. One of these references (11) relates that visitors who had come to the coronation of Montezuma were offered "wild mushrooms" to eat; these intoxicated them and made them dance. Duran, quoted by Bourke (2) states that after the sacrifice of human beings at the coronation of Montezuma II, the multitude ate raw mushrooms and that these induced an intoxication which was much stronger than alcoholic-intoxication; many committed suicide during the height of the intoxication; some received visions and were, in this way, permitted to foresee the future. It is probably safe to assume that the plants spoken of in these two instances were the teonanacatl, *Paneolus campanulatus* var. *sphinctrinus* or a related species. The great similarity in the intoxication to that which Ford (6) has described for *Paneolus* would seem to suggest that the intoxicant was a member of this genus.

Thompson (27) reports Saville as stating that Tizoc, an Aztec ruler who was poisoned after a five year reign, may have been killed by the substitution of poisonous mushrooms for the intoxicating kind which were normally eaten at ceremonies. It is probable that, if this were the case, the deadly *Amanita phalloides* (Fr.) Quél. was

the instrument of death. Since this extremely poisonous mushroom could never be overlooked and mistaken for a species of *Paneolus*, it argues that the mushrooms must have been utilized dry, in which condition substitution would have been less difficult.

The discovery of the use of *Paneolus campanulatus* var. *sphinctrinus* as a narcotic among the Mazatecs of Oaxaca and its identification as the teonanacatl of ancient Mexico greatly enhances our knowledge of the useful Basidiomycetes. While the genus *Paneolus* has been known to have poisonous and narcotic properties, its use for intoxication has not been reported, so far as I have been able to learn, for any primitive peoples outside of Mexico. *Amanita muscaria* (L.) Pers., the fly-agaric, has been used somewhat ritually as a narcotic intoxicant by the natives of Kamchatka, and this has received rather intensive botanical, chemical, medical, and ethnological study for many years. *Amanita muscaria*, like *Paneolus campanulatus* var. *sphinctrinus*, is widely spread, but its use as a definite narcotic is confined to the relatively small Kamchatka area of northeastern Siberia, as the use of *Paneolus campanulatus* var. *sphinctrinus* as a narcotic is apparently known only from Mexico. Dorman in Bourke (2) reports that mushrooms were worshipped in the Antilles, in Virginia, and in California. Such a practice might be interpreted as indicating possibly a former use of the plant as a narcotic to produce oracular delirium. Possibly, however, the reverence accorded to the mushrooms is due to other entirely unrelated causes.

IV. Summary

1). *Paneolus campanulatus* L. var. *sphinctrinus* (Fr.) Bresadola is used as a narcotic in daily life and in divination and witchcraft among the Mazatec Indians of northeastern Oaxaca.

2). A species of *Paneolus* is employed as a narcotic by the Otomi Indians of Puebla and adjacent regions.

3). The size, color, form, growth habits, uses, and narcotic effects of *Paneolus campanulatus* var. *sphinctrinus* correspond so closely to the descriptions of the same aspects of the hitherto unknown *teonanacatl* of the early Mexican writers that there can be little doubt that this species represents the intoxicating mushroom which was in very wide use in daily life, in ceremonies, and in divination and witchcraft among the Aztecs and Chichimecas at the time of the Spanish Conquest.

4.) The discovery of the use of *Paneolus campanulatus* var. *sphinctrinus* as a narcotic and the identification of this fungus with teonanacatl should dispel the confusion which has resulted in literature from Safford's misidentification of teonanacatl with peyote.

5). References in the early literature indicate that the Aztecs possessed an extensive knowledge of the useful and harmful Basidiomycetes.

6). Although species of *Paneolus* are found all over the world and are known to possess intoxicating or slightly poisonous properties, no reference to their use as narcotics is known for primitive peoples outside of Mexico.

BIBLIOGRAPHY

1. Bancroft, Hubert Hugh "The native races" vol. 2, p. 360, San Francisco, 1882.
2. Bourke, John G. "Scatological rites of all nations" Washington, 1891.
3. Bresadola, J. "Iconographia Mycologica" t. 894, Milan, 1931.
4. Britton, N.L. and Rose, J.N. "The Cactaceae" vol. 3, Washington, D.C., 1922.
5. Douglas, B. "Mushroom poisoning" Torreya, vol. 17, pp. 171-175, 209-221, 1917.
6. Ford, W.W. "A new classification of mycetismus (mushroom poisoning)" Trans. Assoc. Am. Physic., vol. 38, pp. 225-229, 1923.
7. Fries, Elias "Epicrisis systematis mycologici seu synopsis Hymenomycetum" pp. 235-236, Upsala, 1836-38.
8. Hernandez, Francisco "De historia plantarum Novae Hispaniae" vol. 2, p. 357, Rome, 1790.
9. Johnson, Jean Bassett "Elements of Mazatec witchcraft" Am. Anthrop., ined.
10. Kingsborough, Lord "Antiquities of Mexico" vol. 9, *Ritos antiquos*, p. 17, London-New York, 1848.
11. Kingsborough, Lord "Antiquities of Mexico" vol. 9, *Cronica mexicana*, p. 153, London-New York, 1848.
12. Krieger, Louis C.C. "A popular guide to the higher fungi (mushrooms) of New York State" N. Y. State Mus. Handb. 11, Albany, 1935.
13. La Barre, Weston "Native American beers" Am. Anthrop., vol. 40, no. 2, pp. 224-234, April-June, 1938.
14. La Barre, Weston "The peyote cult" Yale Univ. Publ. Anthrop., no. 19, pp. 128-130, 1938.
15. Reko, Blas Pablo "De los nombres botánicos aztecos" El. Mex. Ant., vol. 1, no. 5, pp. 113-157, December 1919.
16. Reko, Victor A. "Was bedeutet das Wort *Teonanacatl?*" Unpublished manuscript.

17. Reko, Victor A. "Magische Gifte—Rausch-und Betäubungsmittel der Neuen Welt" Stuttgart, 1936.

18. Safford, W[illiam] E. "Identification of *teonanacatl* of the Aztecs with the narcotic cactus *Lophophora Williamsii* and an account of its ceremonial use in ancient and modern times" Bot. Soc., Washington, D.C., May, 1915.

19. Safford, W[illiam] E. "An Aztec narcotic" Journ. Hered., vol. 6, pp. 291-311, 1915.

20. Sahagun, Bernadino de [Editor: Bustamente, Carlos Maria de] "Historia general de las cosas de Nueva España" vol. 3, Mexico, 1829-30.

21. Sahagun, Bernadino de [Translators: Jourdanet, D., and Siméon, Remi] "Histoire générale des choses de la Nouvelle Espagne" Paris, 1880.

22. Sahagun, Bernardino de [Translator: Bandelier, Fanny R.] "A history of ancient Mexico" vol. 1, Nashville, 1932.

23. Schultes, Richard Evans "Peyote and plants used in the peyote ceremony" Bot. Mus. Leafl., Harvard Univ., vol. 4, no. 8, April 12, 1937.

24. Schultes, Richard Evans "Peyote *(Lophophora Williamsii)* and plants confused with it" Bot. Mus. Leafl., Harvard Univ., vol. 5, no. 5, November 19, 1937.

25. Serna, Jacinto de la "Manual de ministros de Indios para el conocimiento de sus idolatrias y extirpacio de ellas" in Colección de documentos inéditos para la historia de España vol. 104, pp. 61-63, Madrid, 1892.

26. Siméon, Remi "Dictionnaire de la langue Nahautl ou Mexicaine" Paris, 1885.

27. Thompson, J. Eric "Mexico before Cortez" pp. 31, 74, New York-London, 1933.

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A NEW STATUS FOR ×HABENARIA ANDREWSII

BY
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ONE of the most difficult problems in the Orchidaceae of the eastern United States is that concerning the Purple-fringed Habenarias. An examination of herbarium material, and literature on the subject, should readily convince one that this statement is not an exaggeration.

In 1840, Asa Gray, writing of *Habenaria psycodes* (L.) Spreng. (in Am. Journ. Sci. and Arts 38: 309), said: "So great is the confusion of the synonymy, and so extensive the series of mistakes in regard to this species, that it becomes at first sight questionable whether the Linnean name should not be altogether dropped. But as the description of Linnaeus is perfectly applicable to the species he had in view, and to no other, we are not at liberty to pass by the original name; still less to apply it to a plant subsequently mistaken for this species." Gray retained *H. psycodes* as a true species and reduced the large-flowered plant to *H. psycodes* var. *grandiflora* (Bigel.) A. Gray.

In his work on the genus *Habenaria* in North America, Ames (Orchidaceae 4 (1910) 187) wrote: "It is a hopeless task to attempt to arrive at satisfactory conclusions regarding the correct synonymy of *Habenaria psycodes* and *H. fimbriata*. Early in the history of these

closely allied species confusion was established, and although several authors have endeavored to eliminate it there are obstacles which it is probable will always exist. Botanists have reported their material under one name or the other, and have, with few exceptions, added confusion by unstudied references to literature.'' Ames, who had an opportunity to examine the type specimens, continued: ''For example, Lindley described two varieties of *H. psycodes* which are clearly referable to *H.lacera*, as an examination of his specimens will prove. In his synonymy he refers directly to *Orchis psycodes* L. His *Platanthera crispa*, on the other hand, which he suggested was a natural hybrid, is equivalent to *H.psycodes*, to which species his material identified as *P.incisa* should also be referred. Lindley's material of *P.fimbriata* is conspecific with *H.psycodes*, and his *P.grandiflora* is simply *H.fimbriata*.''

In 1929, Morris and Eames (Our Wild Orchids, p. 164) said: ''. . .there is little or no structural difference to separate it [*H. fimbriata* (Dryander) R.Br. from *H. psycodes*]; the greater divergence of the anther cells, the denticulation of the petals continued down their lateral margins as well as on the apex, even the looser more spreading habit of raceme so often found, are distinctions that tend to disappear where both forms are much of a size.'' They retained *H.fimbriata*, however, as a separate species from *H. psycodes*, basing their retention on the difference in the size of the flowers. They said (l.c. 162) that in the northeast corner of its range *H. fimbriata* ''. . .is so much larger than the Butterfly Orchid [*H. psycodes*] that the two can hardly even be compared, let alone confused.''

Ames, admitting the confusion which existed concerning these two forms of the Purple-fringed Habenarias (l.c. 187), wrote: ''The difficulties are increased ten-

fold when it is realized that *H. psycodes* and *H. fimbriata* are so similar that they are distinguishable only by arbitrary rules. In the preparation of the Orchidaceae for Gray's New Manual a conscientious effort was made to ascertain the distinctive characters of these two species. Although every conspicuous character was carefully studied it was found that the most reliable distinction was the depth of the fringe on the divisions of the labellum; in *H. psycodes* this being one-third the depth of the divisions or less, and in *H. fimbriata* one-third or more."

In its present condition the problem may well be expressed in the words of Gibson (Our Native Orchids (1905) 63): "In the bother of mentally calculating whether a certain specimen of purple-fringed orchis is a large specimen of *H. psycodes*, or a small one of *H. grandiflora*, one is distracted from an enjoyment of its beauty, and is tempted to feel a trifle of impatience at the naming of names, and to wish one were back in the Garden of Eden, where, according to the little boy's version, 'Adam called the elephant an elephant because it looked like an elephant'." It would be pleasant, indeed, to follow Adam's method of naming things, but taxonomy would not, in the end, benefit by such a system.

In 1901, Andrews described, as follows, a plant which he said was a hybrid between *H. psycodes* and *H. lacera* (Michx.) Lodd. (in Rhodora 3:246): "Lower leaves as in *H. lacera* length to 15 cm., width to 3 cm., ratio 5–7:1. Raceme oblong, loosely fewer-flowered. Flowers white tinted rose to light rose-purple. Sepals round-oval, obtuse, lateral deflexed, plane, vertical. Petals cuneate-spatulate, obtuse or slightly retuse, denticulate above, slightly surpassing upper sepal in ratio of about 6:5. Average width of lip about 12 mm. Divisions narrow-cuneate, deeply cleft as in *H. lacera*, few, averaging twice as many as in *lacera*, capillary, long. Arms of col-

umn as in *H.psychodes* or slightly more acute. Glands of pollen-masses slightly oblique, elliptical or slightly kidney-shaped. Pollen-masses intermediate in length, club-shaped; stalk $\frac{3}{4}$ length of mass of pollen or rather more; pollen greenish-yellow. Somewhat two lobed projection from base of stigma not completely obstructing orifice of nectary in middle as in *lacera*. Spur longer than ovary, clavate, much enlarged below. Ovary short or intermediate, 9–12 mm. Locality . . . a very wet meadow in Pownal, Vermont, July 22, 1898 (M.W.White & A.L. Andrews), Aug. 5, 1901 (A.L.Andrews).'' Later, in 1904, Miss Niles (Bog-trotting for Orchids, p. 258) published as *Habenaria Andrewsii* White the plant Andrews had described.

After examining numerous sheets of the *H.psycodes-H.fimbriata* complex, I have come to the conclusion that perhaps the most confusing element in this group is the common occurrence of hybrid plants of *H.psycodes* × *H.lacera* and of *H. fimbriata* × *H.lacera*. It is interesting to note that plants which seem to be so obviously of hybrid origin as do those which I have observed should have escaped the attention of other botanists who have worked with them, and it is perhaps due to the abundance of these hybrid plants that so much confusion has existed in this group in the past. The plants which were first described as ×*H.Andrewsii* seem to me less representative of the hybrid than those shown in Plates I and II. The specimens exhibited by these plates are outwardly more closely allied to the large Purple-fringed Orchid than to the small one. Nevertheless, under the status in which I am considering them, all the hybrid plants observed in this study will be treated as ×*H.Andrewsii*. In order to do this, however, it will be necessary to broaden our conception of the hybrid.

In dealing with the parent species of ×*H.Andrewsii*,

I propose to retain *H. psycodes* (L.) Spreng. as such, based upon an examination of a photograph of the Linnean type and upon his description. Also, since it is practically impossible to segregate many of the plants having intermediate characters into the *H. psycodes* and *H. fimbriata* categories, and because there seem to be no fundamental morphological differences in the plants as a whole, I propose to recognize arbitrarily the larger-flowered plants as *H. psycodes* var. *grandiflora*. Plants of *H. lacera* which are found throughout most of its area of distribution are clearly distinguishable as such and afford no problem. However, some of those plants found in the northern extremes of its distribution have, in some cases, been confused with ×*H. Andrewsii* and *H. psycodes*.

Considering the above status of the Purple-fringed Habenarias, and realizing the great variability which is characteristic of hybrid plants, I have deemed it best to group all of the hybrids into one polymorphic, heterogeneous category instead of trying to distinguish individual hybrid plants of *H. psycodes*×*H. lacera* from those of *H. psycodes* var. *grandiflora*×*H. lacera*. I feel confident that, if the above suggestions are taken into consideration, much of the confusion of the past will be clarified and the future treatment of these plants greatly simplified.

With this broader conception of ×*H. Andrewsii* in mind, I believe that a reexamination of Lindley's specimens may possibly disclose that he had in hand one or more of the various forms of the hybrid which led him to recognize five segregates in this bewildering group of plants; but this, of course, is mere supposition. If, however, one of his type specimens should prove to be the hybrid it would become necessary to adopt this earlier name and thus relegate ×*H. Andrewsii* to synonymy.

An examination of the floral illustrations of × *H. Andrewsii* (Plate I, figs. 5–8; Plate II, figs. 16–22) will show a great variation in the flowers of this hybrid, particularly so in the median lobe of the lip which may be entire and spatulate-clavate to deeply-fringed and broadly cuneate or narrowly flabellate. The median lobe, as well as the lateral lobes, of the lip of × *H. Andrewsii* is consistently narrower than in *H. psycodes* or in *H. psycodes* var. *grandiflora*, and wider and longer than in *H. lacera*. The capillary fringes, when present, are for the most part longer than in either of the purple-fringed plants and more numerous than in *H. lacera*. The most constant character of the hybrid, and the one which immediately distinguishes it, is the shape of the petals. They are inclined to be linear-oblong to linear-spatulate as in *H. lacera*. However, although they are for the most part entire, they may also be somewhat denticulate as in the Purple-fringed Orchids.

It is highly probable that further examination of herbarium material of *H. psycodes* and *H. psycodes* var. *grandiflora* will disclose that the hybrid has a much wider range than is known at present, and that it is not at all uncommon. I am citing all the material which I have thus far seen. According to these records, the hybrid ranges from Newfoundland, Nova Scotia, New Brunswick, Quebec, through New England, New York, and New Jersey, south to North Carolina.

The greatest number of collections of × *H. Andrewsii* has been made from New England northward. This is to be expected since the parent species are most abundant in that region and are often found growing in close proximity to one another in the same locality. Southward, *H. psycodes* and *H. psycodes* var. *grandiflora* are confined to the mountains and they become increasingly rarer as they approach their southern limits of distribution. *H.*

lacera, however, not only occurs somewhat sparingly in the mountains, but also extends out into the higher hills of the Piedmont Plateau in Alabama, Georgia and South Carolina, and even into the Coastal Plain of North Carolina. Therefore, besides becoming rarer, the parent species become widely scattered as they approach their southern limits.

According to the specimens examined, *H. lacera* has been found in only two counties in the southeastern states where at least one of the purple-fringed segregates has also been found. These are Mitchell and Transylvania Counties in North Carolina. This absence of the parent species growing in the same region accounts, perhaps, for the rarity of ×*H. Andrewsii* south of New England.

DESCRIPTION: Roots somewhat fleshy, fusiform, elongated. Plant essentially glabrous throughout, 16–75 cm. high. Leaves oblong-obovate, elliptic or lanceolate, 7–20 cm. long, 2.5–8 cm. wide. Dorsal sepal oblong to ovate-elliptic or ovate-orbicular, concave, obtuse, 4–9 mm. long, 2–5 mm. wide. Lateral sepals asymmetrically ovate, ovate-elliptic or ovate-oblong, obtuse to acute, 4–11 mm. long, 2–6 mm. wide. Petals essentially linear-oblong (oblong-elliptic to narrowly oblong-spatulate), essentially entire, commonly with irregularly denticulate-crenulate margins, erose, or rarely with obsolescent subhastate-fringed lobes at base with entire upper half, 4–11 mm. long, 1–4 mm. wide; apex broadly rounded, obtuse-truncate, rarely sinuate-retuse. Lip tripartite, 6–17 mm. long, 8–22 mm. wide across the lateral lobes; lateral lobes narrowly cuneate-flabellate, 5–11 mm. long, laciniate half way to the base or more (often to the base) with long capillary fringes; median lobe entire and spatulate-clavate to deeply-fringed and broadly cuneate or narrowly flabellate, rarely narrowly oblong-spatulate or orbicular with coarse, shallowly eroded apex, 4–14 mm. wide. Spur

slightly to strongly clavate, curved, 1.3–3.5 cm. long.

The following collections of ×*H. Andrewsii* have been examined:

NEWFOUNDLAND: Avalon Peninsula, shores of Conception Bay, boggy meadow overlying clay-slates, sandstones, and quartzites, along Upper Gully, Killigrew's (fls. cream-colored, rarely crimson), Aug. 3, 1911, *M.L.Fernald and K.M.Wiegand 5216* (Gray and Ames Herbaria). Force le Plain, Harry's Brook, July 12, 1930, *Rachel B. Kennedy 345* (Gray Herb.). Force le Plain, Harry's Brook, July 27, 1930, *Rachel B. Kennedy 409* (Gray Herb.).

NOVA SCOTIA: Cape Breton Co., North Sydney, boggy places, July 12, 1883, *John Macoun* (Gray Herb.). Halifax Co., swale near Wellington Station, Shubenacadie, Grand Lake, July 27, 1921, *M.L. Fernald, E. B. Bartram, and B. Long 23705*, in part (Gray Herb.). Pictou Co., near Pictou, damp meadow, July 12-18, 1901, *C.D.Howe and W.F.Lang 546* (Gray Herb.).

NEW BRUNSWICK: Westmorland Co., Shediac Cape, moist grassland with *H.fimbriata* and *H.lacera* (lavender tinted almost white), Aug. 4, 1914, *F.T.Hubbard* (Pl. II, fig. 17) (Ames Herb.); Shediac, moist roadside (fls. pale lilac), Aug. 1, 1910, *F.T.Hubbard 4* (Ames Herb.); Shediac, moist roadside (fls. white), Aug. 1, 1910, *F.T. Hubbard 5* (Ames Herb.); Shediac, moist roadside (fls. almost white), July 30, 1910, *F. T. Hubbard 3* (Ames Herb.); Shediac Cape, moist grassland, with *H.fimbriata* and *lacera* (white), Aug. 4, 1914, *F.T. Hubbard* (Pl. II, fig. 19) (Ames Herb.); Shediac Cape, with *H.fimbriata* and *H.lacera* (light lavender-purple), Aug. 4, 1914, *F.T.Hubbard No. D* (Pl. I, fig. 7) (Gray Herb.); Shediac Cape, with *H.fimbriata* and *H.lacera*, in moist grassland (lavender tinted almost white), Aug. 4, 1914, *F. T. Hubbard No. C* (Pl. I, fig. 5) (Gray Herb.); Shediac Cape, with *H.fimbriata* and *H.lacera* in moist grassland (white), Aug. 4, 1914, *F. T. Hubbard No. B* (Pl. II, fig. 22) (Gray Herb.); Shediac Cape, moist grassland with *H.psycodes* (pale purple), Aug.4, 1914, *F. T. Hubbard* (Gray Herb.); Shediac Cape, with *H.fimbriata* and *lacera* in moist grassy land (pale lavender), Aug. 4, 1914, *F. T. Hubbard No. A* (Pl. I, fig. 6) (Gray Herb.); Shediac Cape, with *H. fimbriata* in moist grassland (white), Aug. 4, 1914, *F. T. Hubbard* (Pl. II, fig. 21) (Gray Herb.); Shediac Cape, with *H.fimbriata* and *lacera*, moist grassland (pale lavender), Aug. 4, 1914, *F. T. Hubbard*

(Pl. II, fig. 18) (Ames Herb.). Ingleside, July 18, 1904, *G. U. Hay* (Gray Herb.).

Quebec: Quebec Co., Bois près du Lac des Roches, (Laurentides) 7 milles au nord de Qúebec, 3 août 1922, *Fr. M. Victorin 16031*, in part (Gray Herb.).

Maine: Franklin Co., So. Chesterville, *Miss L. O. Eaton* (Ames Herb.). Oxford Co., Grafton (alba), Aug., 1888, *J. C. Parlin* (Gray Herb.); Bethel, road to Grafton (fls. pure white), July 25, 1895, *E. F. Williams* (Gray Herb.). Piscataquis Co., near City Camp, Wissataquoik Valley, July 17, 1900, *E. F. Williams 1* (Gray Herb.). Washington Co., Hamilton Cove, Lubec, meadow, Aug. 2, 1909, *M. L. Fernald, 1662c, 1662d* (Pl. II, fig. 20), *1662e, 1662g* (Pl. I, fig. 8) (Gray Herb.); Hamilton Cove, Lubec, meadow, Aug. 2, 1909, *M. L. Fernald 1662 f* (Pl. II, fig. 16) (Ames Herb.). Middle Dam (fls. white), Aug. 2, 1903, *E. F. Williams 2* (Gray Herb.).

New Hampshire: Coös Co., Berlin, July 24, 1901, *Tinnie Wheeler* (Gray Herb.); Randolph, July 31, 1902, *A. H. Moore 269* (Gray Herb.). Grafton Co., Orford, Aug. 2, 1907, *E. F. Williams* (Gray Herb.); Bethlehem, Strawberry Hill, July 21, 1891, *J. F. Collins* (Gray Herb.); Hillsboro Co., Manchester (fls. pure white before drying, also fragrant), July 20, 1899, *F. W. Batchelder* (Gray Herb.). Crystal Peak, Squam Range, swamp in brook bed, elev. 1,000 ft., July 10, 1919, *A. E. Lowes* (Ames Herb.).

Vermont: Bennington Co., Pownal, wet meadow, Aug. 5, 1901, *A. L. Andrews* (Type) (Gray Herb.); Pownal, wet meadow, Aug. 4, 1902, *A. L. Andrews* (Co-type) (Ames Herb.). Washington Co., one mile north of South Duxbury, in open, moist bog (growing with *H. lacera* and *H. psycodes*), Aug. 8, 1937, *D. S. and H. B. Correll 7834* (Ames and Duke Univ. Herbaria). Windham Co., Westminster, 1901, *W. H. Blanchard* (Gray Herb.).

Massachusetts: Berkshire Co., Pittsfield, July, 1922, *E. H. Lincoln* (Mr. L. thinks this is the hybrid) (Ames Herb.). Norfolk Co., Dedham, Purgatory Swamp, June 14, 1889, ex Herb. *E. and C. E. Faxon* (Gray Herb.).

New York: Herkimer Co., Wilmont, swampy flats at head of North Lake (form), July 14, 1902, *J. V. Haberer 1898* (Ames Herb.). Oneida Co., White Lake, Forest Port, along Bear Creek, July 12, 1903, *J. V. Haberer 2679* (Ames Herb.).

New Jersey: Summit Mt., July 29, 1898, *J.C.Brunherste* (Ames Herb.).

North Carolina: *Buncombe Co.*: near Balsam Gap, in weeds along path in open balsam woods (fls. rose-lavender), July 30, 1934, *D.S. Correll 142* (Duke Univ. Herb.); near Balsam Gap, growing in rich, moist, weedy soil beneath balsam trees, pH 5, Aug. 8, 1935, *D. S. Correll 3818* (Duke Univ. Herb.).

It was largely through the study of Mr. F. Tracy Hubbard's excellently prepared New Brunswick specimens that I was enabled to arrive at satisfactory conclusions concerning ×*H. Andrewsii*. I wish to thank Professor Oakes Ames, Mr. Charles Schweinfurth and Mr. F.Tracy Hubbard for their helpful suggestions and criticisms.

EXPLANATION OF PLATES

The flowers illustrated in Plates I and II are natural size. They are shown as they were originally pressed in the field.

PLATE I

1-4. *Habenaria lacera*: New Brunswick: Westmorland Co., Shediac Cape, moist grassland with Carices (toothed petals), July 28, 1914, *F. T. Hubbard* (Gray Herb.). [Petals of all the flowers not toothed—D.S.D.]

5. ×*H. Andrewsii*: New Brunswick: Westmorland Co., Shediac Cape, with *H. fimbriata* and *H. lacera*, in moist grassland (lavender tinted almost white), Aug. 4, 1914, *F. T. Hubbard No. C* (Gray Herb.).

6. ×*H. Andrewsii*: New Brunswick: Westmorland Co., Shediac Cape, with *H. fimbriata* and *lacera* in moist grassy land (pale lavender), Aug. 4, 1914, *F. T. Hubbard No. A* (Gray Herb.).

7. ×*H. Andrewsii*: New Brunswick: Westmorland Co., Shediac Cape, with *H. fimbriata* and *H. lacera* (light lavender-purple), Aug. 4, 1914, *F. T. Hubbard No. D* (Gray Herb.).

8. ×*H. Andrewsii*: Maine: Washington Co., Hamilton Cove, Lubec, meadow, Aug. 2, 1909, *M. L. Fernald 1662g* (Gray Herb.).

9. *H. psycodes* var. *grandiflora*: Massachusetts: Norfolk Co., Purgatory-Dedham, July 10, 1861 (no collector given) (Gray Herb.).

10. *H. psycodes* var. *grandiflora*: New Brunswick: Westmorland Co., Shediac Cape, moist grassland, Aug. 4, 1914, *F. T. Hubbard* (Gray Herb.).

11. *H. psycodes*: New Brunswick: Westmorland Co., Shediac Cape, rich low pasture in moss, Aug. 2, 1914, *F. T. Hubbard* (Gray Herb.).

12. *H. psycodes*: New Brunswick: Westmorland Co., Shediac Cape, moist grassland (white), Aug. 4, 1914, *F. T. Hubbard* (Gray Herb.).

PLATE II

13-14. *H. lacera*: New Brunswick: Westmorland Co., Shediac Cape, moist grassland with Carices, July 28, 1914, *F. T. Hubbard* (Ames Herb.).

15. *H. lacera*: Massachusetts: Bristol Co., North Easton, July, 1898, *Carl Blomberg* (Ames Herb.).

16. ×*H. Andrewsii*: Maine: Washington Co., Hamilton Cove, Lubec, meadow, Aug. 2, 1909, *M. L. Fernald 1662 f* (Ames Herb.).

17. ×*H. Andrewsii*: New Brunswick: Westmorland Co., Shediac Cape, moist grassland, with *H. fimbriata* and *H. lacera* (lavender tinted almost white), Aug. 4, 1914, *F. T. Hubbard* (Ames Herb.).

18. ×*H. Andrewsii*: New Brunswick: Westmorland Co., Shediac Cape, with *H. fimbriata* and *lacera*, moist grassland (pale lavender), Aug. 4, 1914, *F. T. Hubbard* (Ames Herb.).

19. ×*H. Andrewsii*: New Brunswick: Westmorland Co., Shediac Cape, with *H. fimbriata* and *lacera*, moist grassland (white), Aug. 4, 1914, *F. T. Hubbard* (Ames Herb.).

20. ×*H. Andrewsii*: Maine: Washington Co., Hamilton Cove, Lubec, meadow, Aug. 2, 1909, *M. L. Fernald 1662d* (Gray Herb.).

21. ×*H. Andrewsii*: New Brunswick: Westmorland Co., Shediac Cape, with *H. fimbriata* in moist grassland (white), Aug. 4, 1914, *F. T. Hubbard* (Gray Herb.).

22. ×*H. Andrewsii*: New Brunswick: Westmorland Co., Shediac Cape, with *H. fimbriata* and *H. lacera* in moist grassland (white), Aug. 4, 1914, *F. T. Hubbard No. B* (Gray Herb.).

23. *H. psycodes*: New Brunswick: Westmorland Co., Shediac Cape, wet, low pasture in moss, Aug. 2, 1914, *F. T. Hubbard* (Ames Herb.).

24. *H. psycodes* var. *grandiflora*: New Brunswick: Westmorland Co., Shediac Cape, moist grassland, Aug. 4, 1914, *F. T. Hubbard* (Ames Herb.).

25-26. *H. psycodes* var. *grandiflora*: Massachusetts: Middlesex Co., North Tewksbury, in open, boggy woods, June 26, 1902, *Oakes Ames* (Ames Herb.).

27. *H. psycodes* var. *grandiflora*: Massachusetts: Middlesex Co., North Tewksbury, in rich, boggy woods with *Veratrum viride*, June 26, 1902, *Oakes and Blanche Ames* (Ames Herb.).

PLATE 1

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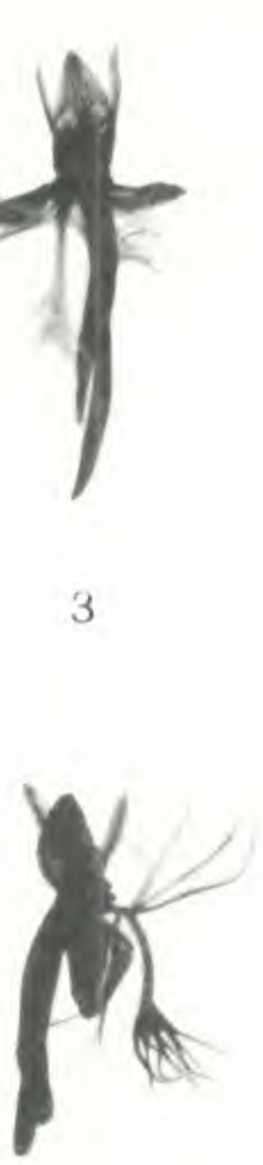

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PLATE 2

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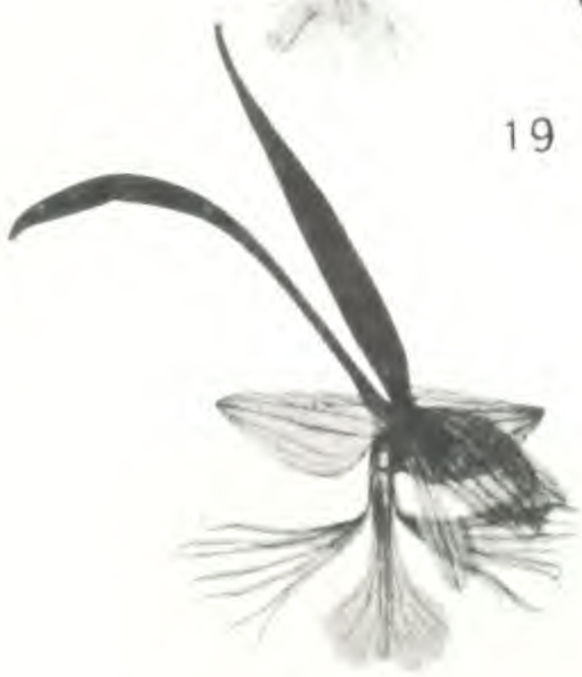

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CAMBRIDGE, MASSACHUSETTS, JUNE 6, 1939 VOL. 7, NO. 5

NOTES ON THE TAXONOMY OF ANANAS AND PSEUDANANAS

BY
LYMAN B. SMITH

THERE is no substitute for careful field observation in attacking taxonomic problems. This axiom is nowhere more evident than in the problems presented by *Ananas* and *Pseudananas*. First, opinion has wavered as to the generic distinction of *Pseudananas*, its single species being proposed originally as an *Ananas*, raised to a section by Hassler and to a genus by Harms, reduced to *Ananas* by Mez, and here raised to a genus again. Similarly, the species of *Ananas* have had extremely varied treatment. Numerous slight forms of *A. comosus* have been proposed as species and the wild pineapples have been viewed differently by each succeeding author. From the evidence of herbarium specimens I had felt that *Ananas* was a monotypic genus. Copious field evidence has convinced me to the contrary.

In late 1938 and early 1939, Dr. K. F. Baker and Dr. J. L. Collins made an extensive field survey of *Ananas* and *Pseudananas* in South America for the Experiment Station of the Pineapple Producers Coöperative Association of Hawaii. During the same trip they visited several botanical institutions and evaluated names of *Ananas* current in parts of South America but not understood elsewhere. More particularly they clarified the various names

in *Ananas* proposed by Bertoni in his monograph of the genus. They have kindly allowed me to present the taxonomic part of their findings.

From the extensive notes, photographs and specimens which they brought back it is evident that *Pseudananas* is a distinct genus and that *Ananas* consists of several well marked species. The data for the above as well as the evaluation of names are presented here in the form of a key and brief notes. Unless otherwise stated, measurements are from herbarium specimens.

1. Syncarp bearing at maturity a minute inconspicuous coma of reduced squamiform bracts, never producing slips at its base; plant producing elongate stolons at base; petals bearing appendages in the form of lateral folds *Pseudananas macrodontes*

1. Syncarp bearing at maturity a conspicuous coma of foliaceous bracts, frequently producing slips at its base; plant not producing stolons; petals each bearing two infundibuliform scales *ANANAS*

2. Syncarp well over 15 cm. long at maturity with copious palatable flesh; scape stout and usually short

3. Floral bracts conspicuous, imbricate and concealing the tops of the ovaries, strongly serrate, usually brightly colored *A. bracteatus*

3. Floral bracts relatively inconspicuous and soon exposing the tops of the ovaries, weakly serrulate or entire; seeds lacking or very rare *A. comosus*

2. Syncarp 15 cm. long or usually much less, with scant unpalatable flesh at maturity; scape elongate, slender

4. Leaves stiffly erect, entire except for a long terminal spine, 35 mm. broad *A. erectifolius*

4. Leaves recurving, serrate, not over 25 mm. broad *A. ananassoides*

Pseudananas macrodontes *(E. Morr.) Harms*

in Engler & Prantl Nat. Pflanzenfam. ed. 2, 15a (1930) 153—Castellanos in Rev. Cent. Estud. Doct. Cienc. Nat. 2 (1938) 14, t. 5.

Ananas macrodontes E. Morren in Belg. Hortic. 28

(1878) 140, t. 4–5—Hassler in Ann. Conserv. Jard. Bot. Genève 20 (1919) 276, 277 with fig., 280—Castellanos in Com. Mus. Nac. Hist. Nat. Buenos Aires 2 (1925) 136—Mez in Engler Pflanzenreich IV. 32 (Heft 100) (1934) 104.

Ananas microcephalus Baker sensu Bertoni Monogr. Gen. Ananas in An. Cient. Paraguay. ser. 2, no. 4 (1919) 250.

The petal appendages in *Pseudananas* consist of a pair of thick fleshy ridges which are produced along their inner edges so that they overlap the filament of the epipetalous stamen. They are thus wholly unlike the delicate funnel-shaped appendages of *Ananas*.

As already indicated by Castellanos, Bertoni's use of *Ananas microcephalus* corresponds to *Pseudananas*. The identity of true *A. microcephalus* is wholly uncertain. Baker and Collins could find no material to support the varieties proposed by Bertoni either in his collection or in localities from which the varieties had been described. All their material indicates that *Pseudananas macrodontes* is a very uniform species.

Ananas bracteatus *(Lindl.) Schultes* in Roemer & Schultes Syst. 7 (1830) 1286.

Ananassa bracteata Lindley in Bot. Reg. 13 (1827) t. 1081.

Ananas Sagenaria (Arr. da Cam.) Schultes sensu Mez in Engler Pflanzenreich IV. 32 (Heft 100) (1934) 104, haud *Bromelia Sagenaria* Arruda da Camara Diss. (1810) 13.

The description of *Bromelia Sagenaria* shows certain similarities with *Ananas bracteatus*, but it shows also differences that it is practically impossible to explain away. For instance the floral bracts are given as about twice as large as they are ever known to occur in *Ananas*

bracteatus. Consequently it seems better to keep the later name, about which there is no uncertainty and relegate *Bromelia Sagenaria* to the dubious list.

Ananas bracteatus shows three well marked varieties as follows:

Ananas bracteatus *(Lindl.) Schultes* var. **typicus** *L.B.Smith.*

Ananas bracteatus (Lindl.) Schultes var. *rudis* Bertoni Monogr. Gen. Ananas in An. Cient. Paraguay. ser. 2, no. 4 (1919) 256, excluding synonymy.

Laminis foliorum omnino viridibus; bracteis florigeris pulchre roseis.

This typical variety with its uniformly green leaves and brightly colored bracts is doubtless the progenitor of the two others. According to Baker and Collins, its seeds are so few that it is cultivated for its fruit in some regions.

Ananas bracteatus *(Lindl.) Schultes* var. **albus** *L.B.Smith var. nov.*

Laminis foliorum omnino viridibus; bracteis florigeris omnino albis vel flavo-virentibus.

BRAZIL, State of São Paulo, District of Itapecirica. Paiól do Meio in woods along canal. May 6, 1936. *Hoehne & Gehrt in Herb. Inst. Biol. São Paulo 35297.* (TYPE in Gray Herb.)

The seeds are extremely numerous in the white-bracted variety, so that it is of little use in cultivation according to Baker and Collins. The color of the bracts is due to a lack of anthocyanin. The leaves are a normal green as in the typical variety.

Ananas bracteatus *(Lindl.) Schultes* var. **tricolor** *(Bertoni) L.B.Smith comb. nov.*

Ananas bracteatus (Lindl.) Schultes var. *rudis* Bertoni subvar. *tricolor* Bertoni Monogr. Gen. Ananas in An. Cient. Paraguay. ser. 2, no. 4 (1919) 258.

Foliorum laminis late albo-marginatis, spinis et saepe margine ipso pulchre roseis; bracteis florigeris albis vel pallide roseis, saepe roseo-marginatis.

The beautiful variegation of the leaves in this variety is due to a lack of chlorophyll near the margin.

Ananas comosus *(L.) Merrill* Interpr. Rumph. Amb. (1917) 133.

Bromelia comosa Linnaeus Herb. Amboin. (1754) 21.

Bromelia Ananas Linnaeus Sp. Pl. (1753) 285.

Ananassa sativa Lindley in Bot. Reg. 13 (1827) sub t. 1068.

Ananas sativus (Lindl.) Schultes in Roemer & Schultes Syst. 7 (1830) 1283.

Ananas Ananas (L.) Voss in Vilm. Blumeng. ed. 3, 1 (1895) 964.

Ananas bracteatus (Lindl.) Schultes var. *hondurensis* Bertoni Monogr. Gen. Ananas in An. Cient. Paraguay. ser. 2, no. 4 (1919) 258; and var. *paraguariensis* Bertoni op. cit. p. 259.

The earliest name for the cultivated pineapple is *Bromelia Ananas* L., but as the International Rules of Botanical Nomenclature do not allow exact repetition of the generic name by the specific, the next earliest name must be used. In this way we have *Ananas comosus* (L.) Merrill based on *Bromelia comosa* L. *Ananas sativus* has been much in use but is antedated by the claim of *A. comosus* and so must lapse into synonymy.

No attempt is made here to classify the numerous subdivisions of the species, but in line with the policy of evaluating Bertoni's names, two of his so called varieties of *A. bracteatus* are reduced to the synonymy of this

species. *A. bracteatus* var. *hondurensis* is reduced to *A. comosus* because it is obvious from the description that it was based on a well known form of the cultivated pineapple. Baker and Collins were unable to find any material of this variety in Bertoni's collection. *A. bracteatus* var. *paraguariensis* they found still growing in his garden and obtained specimens which are beyond doubt *A. comosus*.

Ananas erectifolius *L. B. Smith sp. nov.*

Ananas sp. Ducke in Arch. Jard. Bot. Rio de Janeiro 5 (1930) 81.

Foliis rosulatis, strictis, erectis, 1 m. vel ultra longis, laminis ca. 35 mm. latis, apice involuto pungenti excepto omnino inermibus, supra glabris, subtus minute albido-lepidotis; scapo erecto, elongato, gracili, vivo ad 15 mm. diametro; scapi bracteis foliaceis, erectis; syncarpio subcylindrico, vivo ad 12 cm. longo et 5 cm. diametro, basi apiceque ramulis brevibus foliaceis proferente, coma magna; bracteis florigeris parvis, inermibus; sepalis late ovatis, obtusis, 7 mm. longis; petalis 17 mm. longis; seminibus perpaucis vel nullis.

Brazil, cultivated in Estancia Rio Pedras, Campinas, State of São Paulo in 1938 from material brought from the Amazon Basin by Dr. Adolpho Ducke, *Baker & Collins 9* (Type in Gray Herb.); State of Pará, Santarém, 1932, *Roy Carr s.n.* (Field Museum, No. 659515, 659516, 659517).

The stiff upright entire leaves of this species immediately distinguish it from all others. They yield a good fiber for which the plant has been cultivated. The fruit, although practically seedless, is so poor as to be negligible. The species grows abundantly in low open country on the point west of the mouth of the Rio Tapajoz. It is also said to be common in northwestern Maranhão between the Rio Maracassumé and the Rio Tury-Assú.

Ananas ananassoides *(Bak.) L. B. Smith comb. nov.*

Acanthostachys ananassoides Baker Handb. Bromel. (1889) 25.

Ananas microstachys Lindman in Svensk. Akad. Handl. 24, no. 8 (1891) 39, t. 7, figs. 20-23.

Ananas sativus (Lindl.) Schultes var. *microstachys* (Lindm.) Mez in Martius Fl. Bras. 3, pt. 3 (1892) 294.

Ananas guaraniticus Bertoni Monogr. Gen. Ananas in An. Cient. Paraguay. ser. 2, no. 4 (1919) 274.

Ananas comosus (L.) Merrill var. *microstachys* (Lindm.) L. B. Smith in Contrib. Gray Herb. 104 (1934) 72.

The name *ananassoides* is the earliest name in the specific category to be used for this pineapple and since it is not an exact repetition of the generic name it must stand according to the International Rules of Botanical Nomenclature.

Ananas ananassoides *(Bak.) L. B. Smith* var. **typicus** *L. B. Smith.*

Foliorum laminis recurvatis, elongatis, sed basi raro ultra 25 mm. latis, spinoso-serratis; scapo elongato, gracili, sub syncarpium fragili; syncarpio multifloro, ad 15 cm. longo sed plerumque minore; coma plerumque mediocri sed umbraticola majore; seminibus multis.

Typical *Ananas ananassoides* is characterized by its long narrow recurving leaves and small slender seedy syncarp which easily breaks off from the summit of the scape. It is a plant of very poor soils and is usually found in low open scrub or brushland.

Ananas ananassoides *(Bak.) L. B. Smith* var. **nanus** *L. B. Smith var. nov.*

Foliorum laminis recurvatis, elongatis, angustis;

scapo erecto, gracili, debili, sed apice non fragili; syncarpio paucifloro, parvo, maturitate haud ultra 4 cm. longo; maturitate coma magna in speciminibus visis; seminibus perpaucis vel nullis; sepalis 6 mm. longis; petalis 15 mm. longis.

Brazil, State of Parahyba, cultivated as a pot plant, ornamental, João Pessoa, March 1, 1939, *Baker & Collins s.n.* (Type in Gray Herb.); State of Pernambuco, cultivated ornamental, Recife, March 4, 1939, *Baker & Collins s.n.* (Gray Herb.); State of Pará, Tapary on the Rio Tapajoz, May 1929, *Dahlgren & Sella 28* (Field Museum).

Natives told of seeing this variety in the wild state in the vicinity of Recife, but Baker and Collins were unable to verify the statement. The variety is cultivated in Rio de Janeiro and Bahia as well as in the places indicated above.

The scape is so weak that in cultivation it has to be supported, indicating that its natural habitat is probably fairly dense brushland. The very small few-flowered and nearly or quite seedless syncarp distinguish this variety from the typical one. Also, perhaps partly because of its smaller size, it shows no tendency to break at the junction of the scape and the syncarp. The coma is relatively large in the only known mature specimens, but this may be due to living in the shade because the coma of typical *A. ananassoides* is much larger in shaded plants.

EXPLANATION OF THE ILLUSTRATIONS

PLATE I. ANANAS ERECTIFOLIUS *L.B.Smith*. 1, rosette about one quarter natural size. 2, inflorescence, about one quarter natural size. Drawn from K.F.Baker's photographs of the plants cultivated in Campinas.

PLATE II. ANANAS ANANASSOIDES *(Bak.) L.B.Smith*. 1, plant cultivated in Hort. Bertoni under the name of *Ananas guaraniticus*. Drawn from a photograph by K.F.Baker. 2, syncarp of same plant about one third natural size. 3, section of leaf, natural size, from Baker & Collins collection from near Nioac, Matto Grosso. 4, sepal, natural size from Baker & Collins material in formalin from Mogy-Mirim, São Paulo. 5, petal of same, natural size.

PLATE III. ANANAS ANANASSOIDES *(Bak.) L.B.Smith* VAR. NANUS *L.B. Smith*. Upper scape and inflorescence of type, one half natural size.

Plate I

Ananas erectifolius *L. B. Smith*

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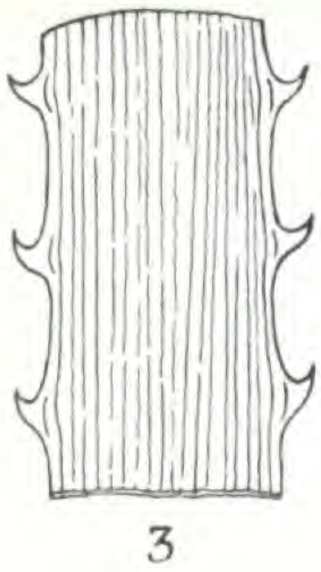

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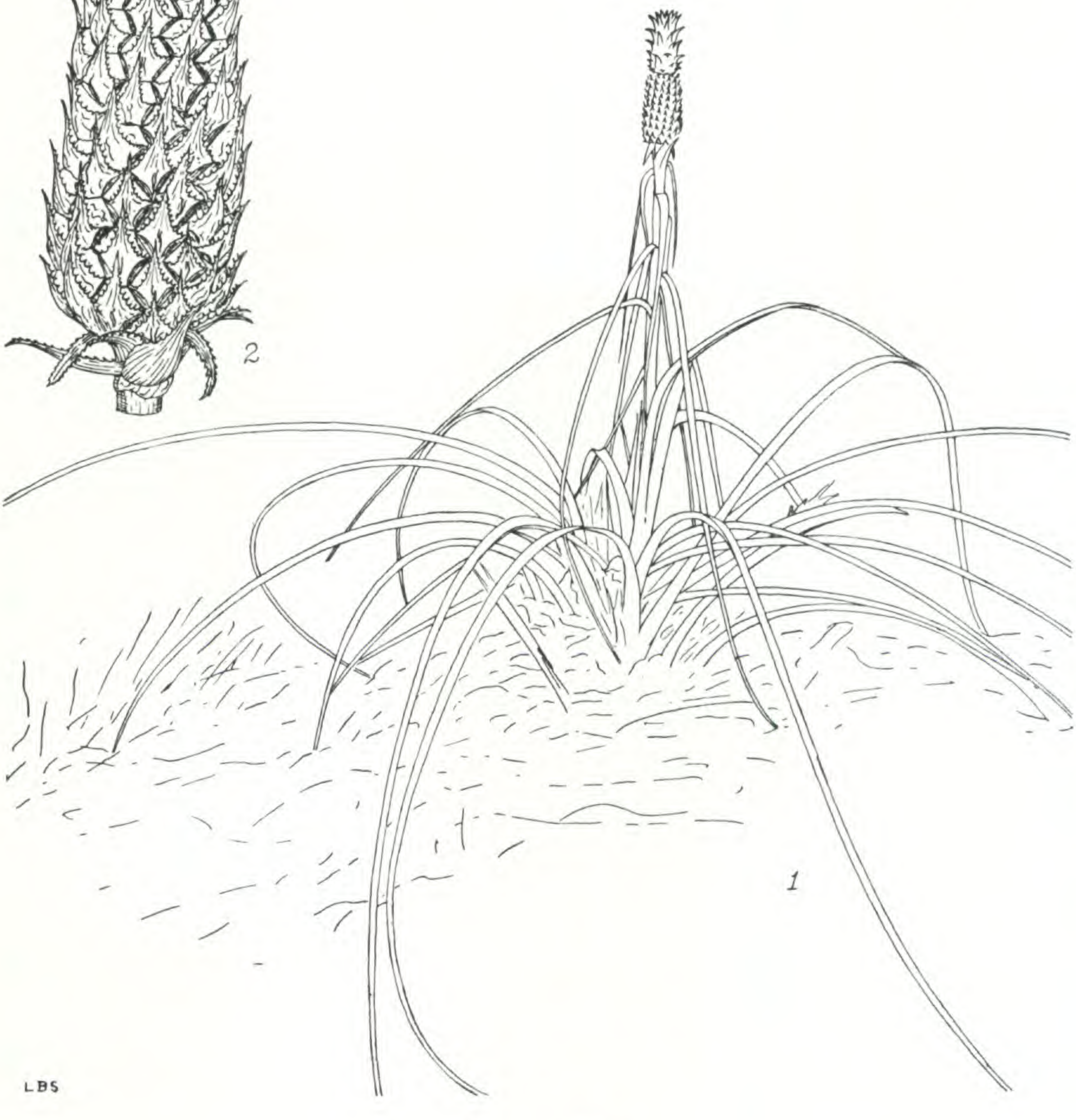

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Plate II

Ananas ananassoides *(Bak.) L. B. Smith*

Plate III

Ananas ananassoides *(Bak.) L. B. Smith* *var.* nanus *L. B. Smith*

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CAMBRIDGE, MASSACHUSETTS, JUNE 19, 1939 VOL. 7, NO. 6

THE CORRECT NAMES OF CERTAIN ECONOMIC PLANTS

BY
ALBERT F. HILL

THE ACCEPTANCE of the International Rules of Botanical Nomenclature, as revised at Cambridge in 1930 and Amsterdam in 1935, by botanists in all parts of the world was welcomed as a forward step toward the eventual standardization of plant names. Once achieved this will eliminate the endless confusion which has resulted from the use, at times, of two or more names for the same species, a condition especially troublesome in the case of economic plants.

This standardization of botanical nomenclature under the Rules must of necessity be a slow and gradual process. Institutions that are sufficiently well equipped with library and herbarium facilities to carry on the work are comparatively few in number, and have many other interests with which to occupy their time. Furthermore, after the correct names have been made known a certain amount of time must elapse before they can be expected to come into general use.

Although considerable progress has been made in pointing out necessary nomenclatorial changes, it is to be regretted that the adoption of these changes by the general botanical public has not proceeded as rapidly, even when the correct names have been published in lit-

erature which is readily available to most botanists. In many instances, however, these names have been pointed out in periodicals or books with a limited distribution or in works of a purely taxonomic nature, and so have escaped the notice of workers in other fields of botany or those whose library facilities are limited. As a consequence the botanical layman has come to depend more and more on the great centers of systematic botany, not only for the prosecution of taxonomic and nomenclatorial research, but more particularly for up-to-the-minute information regarding these matters.

In May 1937, there was published under the auspices of the Royal Botanic Gardens, Kew, a book by J. H. Holland entitled "Overseas Plant Products." Constituting as it does a dictionary of the natural products of vegetable origin of the Empire, with the trade and vernacular names and their scientific equivalents listed, this work will be of great service to anyone who has to do with economic plants or plant products. It should not be too much to assume that, since this volume was sponsored by Kew, the nomenclature involved would be in full accordance with the revised Rules of Nomenclature, certainly in those cases where the correct names had already been pointed out.

It is therefore surprising and disappointing to find so many inaccurate names listed in the work. This failure on the part of one of the leading centers of taxonomic research to make every effort to ascertain and utilize the correct name by which each species should be known under the Rules cannot but slow up the progress which is being made toward the standardization of the names.

It seems advisable for the benefit of those botanists who may have access to Holland's otherwise very valuable work, and for the sake of accuracy in possible future editions, to call attention to certain of the plants the

names of which are incorrectly listed. Only species for which the correct name had been pointed out prior to 1936 will be included. To coincide with Holland these species will be listed in alphabetical order according to their common names, and page references to Holland will be cited. In each case the correct scientific name will be given, together with the place of publication and the essential synonymy. In those instances where the error in Holland is due to failure to take up the earliest specific epithet available for a given species, no comment will be necessary. Elsewhere a few notes may be in order.

Acorns p. 1. See Oak (Sweet Acorn).

Akar Lanyere (Akar langir) p. 2.

Securidaca inappendiculata *Hasskarl* Pl. Jav. Rar. (1848) 295.

Securidaca Tavoyana Wallich ex Bennett Fl. Brit. Ind. 1 (1872) 208—Holland 2.

Babassu p. 9. See Palm (Babassu).

Balata p. 10.

Manilkara bidentata *(A.DC.) Chevalier* in Rev. Bot. Appl. 12 (1932) 270.

Mimusops bidentata A.DeCandolle in DC. Prodr. 8 (1844) 204.

?*Mimusops globosa* Gaertner filius Fruct. et Semen. 3 (1805) 132, t. 205, f. 2—Holland 10.

Mimusops Balata Pierre in Bull. Soc. Linn. Paris (1885) 506, non Gaertner filius.

Manilkara Balata Dubard in Ann. Mus. Colon. Marseille, ser. 3, 3 (1915) 19.

Chevalier has shown that names which include the specific epithet *Balata*, based on *Achras Balata* Aublet, cannot be maintained since they depend on an inaccurate interpretation of Aublet's species. The name *Achras*

Balata Aublet does not apply to the Balata of Guiana, but rather to a plant of Madagascar and Mauritius. De Candolle's name, the next oldest available, must therefore be taken up. Dubard, however, pointed out in 1915 that the American species of *Mimusops* should preferably be referred to *Manilkara*, a view-point with which the majority of taxonomists are in agreement.

BALSA WOOD p. 10.

Ochroma pyramidale *(Cav.) Urban* in Fedde Repert. Beihefte 5 (1920) 123.

Bombax pyramidale Cavanilles in Lamarck Encycl. 2 (1786) 552.

Ochroma Lagopus Swartz Prodr. Veg. Ind. Occ. (1788) 98—Holland 10, 257.

BALSAM (Tolu) p. 11.

Myroxylon balsamum *(Linn.) Harms* in Notizbl. Bot. Gart. Berlin 5 (1908) 94.

Toluifera Balsamum Linnaeus Sp. Pl. (1753) 384.

Myroxylon Toluiferum Humboldt, Bonpland & Kunth Nov. Gen. et Sp. 6 (1823) 375—Holland 11, 19, 155.

BANANA (Chinese or Dwarf) p. 11.

Musa nana *Loureiro* Fl. Cochinch. (1790) 644.

Musa Cavendishii Lambert in Paxton Mag. Bot. 3 (1837) 51—Holland 11.

BAYBERRY p. 243, under Wax (Myrtle).

Myrica pensylvanica *Loiseleur-Deslongchamps* in Duhamel Traité des Arb. Fruit. 2 (1802) 190, t. 55.

Myrica carolinensis auct. plur., non Miller—Holland 243.

BEAN CAKE p. 12, See Soy Bean.

BOX MYRTLE p. 16.

Myrica sapida *Wallich* Tent. Fl. Nep. (1826) 59, t. 45.

Myrica Nagi auct. plur., non Thunberg—Holland 16.

CABRIUVA p. 19. See Balsam (Tolu).

CASSAVA or TAPIOCA p. 24.

Manihot esculenta *Crantz* Inst. Rei Herb. 1 (1766) 167.

Manihot utilissima Pohl Pl. Bras. Ic. Descr. 1 (1827) 32, t. 24—Holland 24, 58, 264.

CHANAR or CHANAL p. 27.

Gourliea spinosa *(Mol.) Skeels* in U. S. Dept. Agric. Bur. Pl. Ind. Bull. 162 (1909) 31.

Lucuma spinosa Molina Sagg. Chili (1783) 188.
Gourliea decorticans Gill ex Hooker Bot. Misc. 3 (1832) 208—Holland 27.

CHIRONJII (Oil) p. 31.

Buchanania Lanzan *Sprengel* in Schrader Journ. (1800) pt. 2, (1801) 234.

Buchanania latifolia Roxburgh Hort. Beng. (1814) 32—Holland 31.

COCA (Truxillo) p. 34.

Erythroxylum novo-granatense *(Morris) Hieronymus* in Engler's Bot. Jahrb. 20, Beibl. 49 (1895) 35.

Erythroxylon Coca Lam. var. *novo-granatense* Morris in Kew Bull. (1889) 5, t. 2.
Erythroxylon truxillense Rusby in Druggist's Circ. & Chem. Gaz. (1900) 220—Holland 34.

COCO-YAM p. 35. See Taro.

COPAL (Gum Animi) p. 37. See Copal (Madagascar).

COPAL (Madagascar) p. 37.

Trachylobium verrucosum *(Gaertn.) Oliver* Fl. Trop. Afr. 2 (1871) 311, *in adnot.*

Hymenaea verrucosa Gaertner Fruct. et Semen. 2 (1791) 306, t. 139, f. 7—Holland 37, 160.

Trachylobium Hornemannianum Hayne in Flora 10 (1827) 744—Holland 37.

Coquito p. 38. See Palm (Chilian).

Cottonwood p. 41.

Populus deltoides *Marshall* Arbust. Am. (1785) 106.

Populus monilifera Aiton Hort. Kew. 3 (1789) 406—Holland 41.

Populus canadensis Michaux filius Hist. Arb. Am. 3 (1813) 298, f. 11, non Moench.

Cow Tree p. 42.

Brosimum utile *(HBK.) Pittier* in Contrib. U.S. Nat. Herb. 20 (1918) 102.

Galactodendron utile Humboldt, Bonpland & Kunth Nov. Gen. et Sp. 7 (1825) 163.

Brosimum Galactodendron D. Don in Sweet Hort. Brit., ed. 2 (1830) 462—Holland 42.

Cube (Barbasco or Bracelet Wood) p. 43.

Jacquinia Barbasco *(Loefl.) Mez* in Engler Pflanzenreich IV. 236a (Heft 15) (1903) 32.

Chrysophyllum Barbasco Loefling Iter Hisp. (1758) 204.

Jacquinia armillaris Jacquin Enum. Pl. Carib. (1760) 15—Holland 43.

Dittany (American) p. 51.

Cunila origanoides *(Linn.) Britton* in Mem. Torr. Bot. Club 5 (1894) 278.

Satureja origanoides Linnaeus Sp. Pl. (1753) 568.

Cunila mariana Linnaeus Syst. Nat., ed. 10 (1759) 1359—Holland 51.

Holland cites the correct name as a synonym.

DOGWOOD (Jamaica) p. 51.

Piscidia piscipula *(Linn.) Sargent* in Gard. & For. 4 (1891) 436.

Erythrina piscipula Linnaeus Sp. Pl. (1753) 707.

Piscidia Erythrina Linnaeus Syst. Nat., ed. 10 (1759) 1155—Holland 51.

EGYPTIAN GRASS (Crowfoot Grass) p. 55.

Dactyloctenium aegyptium *(Linn.) Richter* Pl. Eur. 1 (1890) 68.

Cynosurus aegyptius Linnaeus Sp. Pl. (1753) 72.

Eleusine aegyptia Desfontaines Fl. Atlant. 1 (1798) 85.

Dactyloctenium aegyptiacum Willdenow Enum. Hort. Berol. (1809) 1029—Holland 55.

EJOO or EJOW (Gomuti, Sugar Palm) p. 55. See Palm (Gomuti).

FARINA or FARINHA p. 58. See Cassava.

GALL or GALL-NUTS (Woo-Pei-Tzu) p. 62.

Rhus chinensis *Miller* Gard. Dict., ed. 8 (1768) no. 7.

Rhus semialatum Murray in Comm. Soc. Reg. Sci. Götting. 6 (1784) 27, t. 3—Holland 62.

Rhus javanica Loureiro Fl. Cochinch. (1790) 183, non Linnaeus.

GELSEMIUM (Yellow Jasmine) p. 64.

Gelsemium sempervirens *(Linn.) Aiton filius* Hort. Kew., ed. 2, 2 (1811) 64.

Bignonia sempervirens Linnaeus Sp. Pl. (1753) 623.

Gelsemium nitidum Michaux Fl. Bor.-am. 1 (1803) 120—Holland 64.

The correct name is given under Woodbine, p. 256.

GOURD (Pipe Gourd, Siphon Gourd) p. 66.

Lagenaria siceraria *(Mol.) Standley* in Field Mus. Bot. ser. 3 (Fl. Yucatan) (1930) 435 (Publ. 279).

Cucurbita siceraria Molina Sagg. Chili (1782) 133.

Lagenaria vulgaris Seringe in Mém. Soc. Phys. et d'Hist. Nat. Genève 3, pt. 1 (1825) 25—Holland 66.

HATS (Panama) p. 73. See Panama Hats.

HEMLOCK (Western) p. 75.

Tsuga heterophylla *(Raf.) Sargent* Silva No. Am. 12 (1898) 73, t. 605.

Abies heterophylla Rafinesque in Atlant. Journ. 1 (1832) 119.

Tsuga Albertiana Sénéclauze Conif. (1868) 18—Holland 75.

Holland gives the correct name as a synonym.

HICKORY NUTS p. 77.

Carya tomentosa *(Lam.) Nuttall* Gen. No. Am. Pl. 2 (1818) 221.

Juglans tomentosa Lamarck Encycl. 4 (1797) 504.

Carya alba K. Koch Dendrol. 1 (1869) 596, non Nuttall—Holland 77.

INDIGO p. 82.

Indigofera suffruticosa *Miller* Gard. Dict., ed. 8 (1768) no. 2.

Indigofera Anil Linnaeus Mant. 2 (1771) 272—Holland 82.

IPECACUANHA (Substitute-Undulated or False) p. 83.

Richardia scabra *Linnaeus* Sp. Pl. (1753) 330.

Richardsonia scabra A. St. Hilaire Pl. Usuel. Brés. (1824) t. 8—Holland 83.

KARANJA or MONDA p. 88.

Pongamia pinnata *(Linn.) Merrill* Interpret. Herb. Amb. (1917) 271.

Cytisus pinnatus Linnaeus Sp. Pl. (1753) 741.
Pongamia glabra Ventenat Jard. Malm. 1 (1803) 28, t. 28—Holland 88.

KENTUCKY COFFEE TREE p. 89.

Gymnocladus dioica *(Linn.) K. Koch* Dendrol. 1 (1869) 5.

Guilandina dioica Linnaeus Sp. Pl. (1753) 381.
Gymnocladus canadensis Lamarck Encycl. 1 (1783) 733—Holland 89.

KOHLRABI (Siam Cabbage, Hungarian Turnip) p. 90.

Brassica oleracea *Linn.* var. **gongylodes** *Linnaeus* Sp. Pl. (1753) 667.

Brassica oleracea Linn. var. *caulorapa* DC. Syst. Nat. 2 (1821) 586—Holland 90.

KUDZU (or "KO") p. 91.

Pueraria Thunbergiana *(Sieb. & Zucc.) Bentham* in Journ. Linn. Soc. Bot. 9 (1867) 122.

Pachyrhizus Thunbergianus Siebold & Zuccarini in Abh. Akad. Muench. 4, Abt.3 (1846) 237 (Fl. Jap. Fam. Nat. 2 (1846) 113).
Dolichos hirsutus Thunberg in Trans. Linn. Soc. 2 (1794) 339.
Pueraria hirsuta C. K. Schneider Ill. Handb. Laubholz. 2 (1907) 114, non Kurz—Holland 91.

Holland gives the correct name as a synonym.

KUSSUM p. 92, under Lac (Resin). See Oak (Ceylon).

LIGNUM NEPHRITICUM p. 95.

Eysenhardtia polystachya *(Ortega) Sargent* Silva No. Am. 3 (1892) 29.

Viborquia polystachya Ortega Nov. aut Rar. Pl. Hort. Matrit. (1798) 66, t. 9.

Eysenhardtia amorphoides Humboldt, Bonpland & Kunth Nov. Gen. et Sp. 6 (1824) 491—Holland 95.

LONGANS p. 99.

Euphoria Longan *(Lour.) Steudel* Nomencl. (1821) 328.

Dimocarpus Longan Loureiro Fl. Cochinch. (1790) 233.

Euphoria Longana Lamarck Encycl. 3 (1791) 574.

Nephelium Longana Cambessedes in Mém. Mus. d'Hist. Nat. Paris 18 (1829) 30—Holland 99.

Some authorities, including Holland, consider that this plant should be transferred to the genus *Nephelium*, in which case the correct name is **Nephelium Longan** *(Lour.) Hooker* in Bot. Mag. 70 (1844) t. 4096.

LONGLEAF INDIAN PINE p. 228, under Turpentine (Indian).

Pinus Roxburghii *Sargent* Silva No. Am. 11 (1897) 9.

Pinus longifolia Roxburgh ex Lambert Pinus 1 (1832) 24, t. 26, 27, non Salisbury—Holland 228.

LOPEZ ROOT (Kaka Toddali of Malabar) p. 99.

Toddalia asiatica *(Linn.) Lamarck* Tabl. Encycl. 2 (1793) 116.

Paullinia asiatica Linnaeus Sp. Pl. (1753) 365.

Scopolia aculeata Smith Icon. 2 (1790) sub t. 34.

Toddalia aculeata Persoon Syn. Pl. 1 (1805) 249—Holland 99.

LOTUS (Sacred Lotus) p. 99.

Nelumbium Nelumbo *(Linn.) Druce* in Rept. Bot. Exch. Club Brit. Isles 3 (1914) 421.

Nymphaea Nelumbo Linnaeus Sp. Pl. (1753) 511.
Nelumbo nucifera Gaertner Fruct. et Semen. 1 (1788) 73, t. 19, f. 2--Holland 99.

MANGROVE (Tengah) p. 106.

Ceriops Tagal *(Perr.) C. B. Robinson* in Philipp. Journ. Sci. Bot. 3 (1908) 306.

Rhizophora Tagal Perrottet in Mém. Soc. Linn. Paris 3 (1825) 138.
Ceriops Candolleana Arnott in Ann. Nat. Hist. 1 (1838) 364—Holland 106.

MOLAVE (Lanahan Timber) p. 114.

Vitex parviflora *Jussieu* in Ann. Mus. d'Hist. Nat. Paris 7 (1806) 76.

Vitex littoralis Decaisne in Nouv. Ann. Mus. Paris 3 (1834) 401—Holland 114.

MOXA p. 115.

Crossostephium chinense *(Linn.) Makino* in Bot. Mag. Tokyo 20 (1906) 33.

Artemisia chinensis Linnaeus Sp. Pl. (1753) 849, excl. synon.
Crossostephium artemisioides Lessing ex Chamisso & Schlechtendahl in Linnaea 6 (1831) 220—Holland 115.

OAK (Ceylon Oak, Kussum, Kusambi) p. 122.

Schleichera oleosa *(Lour.) Merrill* Interpret. Herb. Amb. (1917) 337.

Pistacia oleosa Loureiro Fl. Cochinch. (1790) 615.
Schleichera trijuga Willdenow Sp. Pl. 4 (1806) 1096—Holland 92, 122.

OAK (Sweet Acorn) p. 121.

Quercus rotundifolia *Lamarck* Encycl. 1 (1783) 723.

Quercus ballota Desfontaines in Mém. Acad. Sci. Paris (1790) [1797] 395, t. 6—Holland 1, 121.

By many authorities this oak is considered to be a variety of *Quercus Ilex*, in which case the correct name is **Quercus Ilex** *Linn.* var. **rotundifolia** *(Lam.) Rehder* in Journ. Arnold Arb. 1 (1919) 132.

Osage Orange p. 128.

Maclura pomifera *(Raf.) C. K. Schneider* Illus. Handb. Laubholz. 1 (1906) 806.

Toxylon pomiferum Rafinesque in Am. Month. Mag. 2 (1817) 118.

Maclura aurantiaca Nuttall Gen. No. Am. Pl. 2 (1818) 234—Holland 128.

Palas p. 92, under Lac (Resin).

Butea monosperma *(Lam.) Taubert* in Engl. & Prantl Nat. Pflanzenfam. 3, Abt. 3 (1894) 366.

Erythrina monosperma Lamarck Encycl. 1 (1783) 391.

Butea frondosa Roxburgh Pl. Corom. 1 (1795) 21, t. 21—Holland 92.

Palm (Babassu) p. 129.

Orbignya Barbosiana *Burret* in Notizbl. Bot. Gart. Berlin 11 (1932) 690.

Attalea speciosa Martius Hist. Nat. Palm. 2 (1826) 298, t. 96—Holland 9.

"*Attalea funifera*" Holland 129.

Orbignya speciosa (Mart.) Rodr. Sert. Palm. Bras. 1 (1903) 60, non Rodr. (1891)—Holland 9, 129, in synon.

If the Babassu Palm is maintained in *Attalea* the name *Attalea speciosa* which Holland cites on page 9 is

correct. The citation "*Attalea funifera*" on page 129 for the same plant is obviously a mistake. However, if this plant is transferred to *Orbignya*, as Holland does in synonymy, the specific epithet cannot be maintained under the homonym rule.

PALM (Chilian or Coquito Nut; Palm Honey) p. 130.

Jubaea chilensis *(Mol.) Baillon* Hist. Pl. 13 (1895) 397.

Cocos chilensis Molina Sagg. Chili (1782) 180.

Jubaea spectabilis Humboldt, Bonpland & Kunth Nov. Gen. et Sp. 1 (1816) 308, t. 96—Holland 38, 130.

PALM (Gomuti) p. 130.

Arenga pinnata *(Wurmb.) Merrill* Interpret. Herb. Amb. (1917) 119.

Saguerus pinnatus Wurmburg in Verh. Bat. Genoots. 1 (1779) 351.

Arenga saccharifera Labillardière in Mém. Inst. Paris 4 (1801) 209—Holland 55, 130.

PALM (Saw Palmetto) p. 130. See Palmetto (Saw).

PALMETTO (Saw) p. 131.

Serenoa repens *(Bartr.) Small* in Journ. N. Y. Bot. Gard. 23 (1922) 62.

Corypha repens Bartram Travels (1791) 61.

Chamaerops serrulata Michaux Fl. Bor.-am. 1 (1803) 206.

Sabal serrulata Nuttall ex Schultes & Schultes filius Syst. Veg. 7 (1830) 1486.

Serenoa serrulata Hooker filius in Bentham & Hooker filius Gen. Pl. 3 (1883) 926—Holland 130, 131.

PANAMA HATS p. 132.

Carludovica palmata *Ruiz & Pavon* Syst. Veg. (1798) 291.

"*Carludovica insignis*" Holland 73, 132.

The citation of *Carludovica insignis* as the name of the familiar Panama Hat Plant of South America is probably due to an oversight. *Carludovica insignis* Duchass., of which *C. palmata* Grisebach (1857) is a synonym, is a West Indian species.

PARAGUAY TEA (Mate, Yerba Mate, Hervea) p. 134.

Ilex paraguariensis *A. St. Hilaire* in Mém. Mus. d'Hist. Nat. Paris 9 (1822) 351.

Ilex paraguensis D. Don in Lambert Pinus, ed. 2, App. (1824) 7, t. 4—Holland 134.

Ilex paraguayensis Hooker in Bot. Mag. 69 (1843) t. 3992.

PARANA PINE p. 134.

Araucaria angustifolia *(Bert.) O. Kuntze* Rev. Gen. Pl. 3 (1893) 375.

Columbea angustifolia Bertolini Opusc. Scient. Bologna 3 (1819) 411.

Araucaria brasiliana A. Richard Dict. Class. Hist. Nat. 1 (1822) 512.

Araucaria brasiliensis auct. plur.—Holland 134.

PERILLA (Yegoma or Zegoma Oil) p. 141.

Perilla frutescens *(Linn.) Britton* in Mem. Torr. Bot. Club 5 (1894) 277.

Ocimum frutescens Linnaeus Sp. Pl. (1753) 597.

Perilla ocymoides Linnaeus Gen. Pl., ed. 6 (1764) 578—Holland 141.

POISON ROOT (Rat Poison) p. 147, 190, under Sisiak (Rat Poison).

Dianella ensifolia *(Linn.) DeCandolle* in Redouté Lil. 1 (1802) t. 1.

Dracaena ensifolia Linnaeus Mant. (1767) 63.

Dianella nemorosa Lamarck Encycl. 2 (1786) 276—Holland 147, 190.

POKE-WEED p. 147.

Phytolacca americana *Linnaeus* Sp. Pl. (1753) 441.

Phytolacca decandra Linnaeus Sp. Pl., ed. 2 (1762) 631—Holland 147.

POSIDONIA (Marine Fibre, Sea Wrack, Grass Wrack) p. 149.

Posidonia oceanica *(Linn.) Delile* Fl. Aegypt. Ill. (1813) 30.

Zostera oceanica Linnaeus Mant. (1767) 123.
Posidonia caulina Koenig in Koenig & Sims Ann. Bot. 2 (1805) [1806] 96—Holland 149.

POTATOES (Hausa, Salaga, Madagascar) p. 150.

Coleus rotundifolius *(Poir.) A. Chevalier & E. Perrot* in Vég. Util. Afr. Trop. Fr. 1 (1905) 101, 119.

Germanea rotundifolia Poiret in Lamarck Encycl. 2 (1786) 763.
Coleus dysentericus Baker in N. E. Brown in Kew Bull. (1894) 10—Holland 150.
Holland cites the correct name in synonymy.

PYINGADO (Wood) p. 153.

Xylia xylocarpa *(Roxb.) Taubert* in Bot. Centralbl. 47 (1891) 395.

Mimosa xylocarpa Roxburgh Pl. Corom. 1 (1795) 68, t. 100.
Inga dolabriformis Graham in Wallich Cat. (1828) no. 5279.
Xylia dolabriformis Bentham in Hooker Journ. Bot. 4 (1842) 417—Holland 153.

QUINA MORADA p. 154.

Pogonopus tubulosus *(DC.) K. Schumann* in Martius Fl. Bras. 6, pt. 6 (1889) 265.

Calycophyllum tubulosum DeCandolle Prodr. 4 (1830) 367.

Chrysoxylon febrifugum Weddell Hist. Nat. Quinq. (1849) 100.

Pogonopus febrifugus Hooker filius in Bentham & Hooker filius Gen. Pl. 2 (1873) 47—Holland 154.

QUINA-QUINA (Argentine) p. 155. See Balsam (Tolu).

RED TEA (Leaves) p. 159.

Malus hupehensis *(Pamp.) Rehder* in Journ. Arnold Arb. 14 (1933) 207.

Pyrus hupehensis Pampanini (as *Pirus*) in Nuov. Giorn. Bot. Ital., n.s. 17 (1910) 291.

Malus theifera Rehder in Sargent Pl. Wils. 2 (1915) 283.

Pyrus theifera Bailey in Rhodora 18 (1916) 155—Holland 159.

If *Malus* is not segregated from *Pyrus*, the correct name is **Pyrus hupehensis** *Pampanini.*

REED (Common Reed, Roseau a balais, Danube Grass) p. 159.

Phragmites maxima *(Forsk.) Chiovenda* in Nuov. Giorn. Bot. Ital., n.s. 26 (1919) 80.

Arundo maxima Forskal Fl. Aegypt.-Arab. (1775) 24.

Arundo vulgaris Lamarck Fl. Fr. 3 (1778) 615.

Phragmites communis Trinius Fund. Agrost. (1820) 134.

Phragmites vulgaris Crépin Man. Fl. Belg., ed. 2 (1866) 345—Holland 159.

RESIN (Tanrouk Rouchi) p. 160. See Copal (Madagascar).

SABICU (Horseflesh Mahogany) p. 170.

Lysiloma latisiliqua *(Linn.) Bentham* in Trans. Linn. Soc. 30 (1875) 534, *quoad synon. Linn. et Willd., ceteris excl.*

Mimosa latisiliqua Linnaeus Sp. Pl. (1753) 519.
Acacia latisiliqua Willdenow Sp. Pl. 4 (1806) 1067.
Lysiloma Sabicu Bentham in Hooker Kew Journ. 6 (1854) 236—Holland 170.

SAFFRON (Sicilian) p. 172.

Crocus longifolius *Rafinesque* Caratt. (1810) 84, t. 19, f. 2.

Crocus odorus Bivona Stirp. Rar. Sicil. Manip. 3 (1815) 8—Holland 172.

SAINFOIN (Finger-grass Fodder) p. 172.

Onobrychis viciaefolia *Scopoli* Fl. Carniol., ed. 2, 2 (1772) 76.

Onobrychis sativa Lamarck Fl. Fr. 2 (1778) 652—Holland 172.

SAMPHIRE (Jointed Glasswort) p. 174.

Salicornia europaea *Linnaeus* Sp. Pl. (1753) 3.

Salicornia europaea Linn. var. *herbacea* Linnaeus Sp. Pl. (1753) 3.
Salicornia herbacea Linnaeus Sp. Pl., ed. 2 (1762) 5—Holland 174.

SAPOTE (Mammee Sapote, Marmalade Plum) p. 177.

Calocarpum Sapota *(Jacq.) Merrill* Enum. Philipp. Flow. Pl. 3 (1923) 284.

Sideroxylum Sapota Jacquin Enum. Pl. Carib. (1760) 15.
Achras mammosa Linnaeus Sp. Pl., ed. 2 (1762) 469, excl. var. β.
Calocarpum mammosa Pierre in Urban Symb. Antill. 5 (1904) 98—Holland 177.

SASSAFRAS p. 179.

Sassafras albidum *(Nutt.) Nees* Syst. Laurin. (1836) 490.

Laurus (Euosmus) albida Nuttall Gen. No. Am. Pl. 1 (1818) 259.

Laurus variifolia Salisbury Prodr. (1796) 344 *(nomen illegitimum).*

Sassafras officinale Nees & Ebermaier Handb. Med.-Pharm. Bot. 2 (1831) 418—Holland 179.

Sassafras variifolium O. Kuntze Rev. Gen. Pl. (1891) 574.

SAVIN (Indian Savin Tree) p. 180.

Caesalpinia vesicaria *Linnaeus* Sp. Pl. (1753) 381.

Poinciana bijuga Linnaeus Sp. Pl., ed. 2 (1762) 544, excl. synon.

Caesalpinia bijuga Swartz Obs. Bot. (1791) 166—Holland 180.

SESAME (Benn, Gingelly, Til or Teel, Sim-Sim) p. 113, under Mlenda (Seed), 184.

Sesamum indicum *Linnaeus* Sp. Pl. (1753) 634.

Sesamum orientale Linnaeus Sp. Pl. (1753) 634—Holland 113, 184.

Sesamum orientale has only page priority which is not recognized under the Rules. DeCandolle (Pl. Rar. Jard. Genève (1889) 18, t. 5) was apparently the first to combine the two Linnaean species and chose the name *Sesamum indicum* which must be taken up. Holland gives the correct name in synonymy.

SHII-TAKE p. 185.

Cortinellus Berkeleyanus *Ito & Imai* in Bot. Mag. Tokyo 39 (1925) 326.

Collybia Shii-Taki Schroeter in Gartenfl. 35 (1886) 105 *(nomen illegitimum).*

Cortinellus Shii-Taki P. Hennings in Notizbl. Bot. Gart. Berlin 2 (1899) 385—Holland 185.

SONORA GUM (Creosote Plant) p. 192.

Larrea tridentata *(DC.) Coville* in Contrib. U. S. Nat. Herb. 4 (1893) 75.

Zygophyllum tridentatum DeCandolle Prodr. 1 (1824) 706.

"Larrea americana" Holland 192.

Holland's name for the Creosote Plant is probably cited by mistake.

SOY BEAN (China Bean, Japan Pea, White Gram) p. 193.

Glycine Soja *(Linn.) Siebold & Zuccarini* in Abh. Akad. Muench. 4, Abt. 2 (1845) 119 (Fl. Jap. Fam. Nat. 1 (1845) 11.

Dolichos Soja Linnaeus Sp. Pl. (1753) 727.

Phaseolus Max Linnaeus Sp. Pl. (1753) 725.

Soja Max Piper in Journ. Am. Soc. Agron. 6 (1914) 84.

Glycine Max Merrill Interpret. Herb. Amb. (1917) 274—Holland 12, 193.

The specific epithet *Max* cannot be maintained as it has only page priority which is not recognized under the Rules. Holland gives the correct name in synonymy.

SQUILL (Radix Squillae) p. 195.

Urginea maritima *(Linn.) Baker* in Journ. Linn. Soc. Bot. 13 (1873) 221.

Scilla maritima Linnaeus Sp. Pl. (1753) 308.

Urginea Scilla Steinheil in Ann. Sci. Nat., ser. 2, 1 (1834) 330—Holland 195.

TABASHEER or "TABASHIR" (Manna-Bamboo) p. 203.

Bambusa Bambos *(Linn.) Druce* in Rept. Bot. Exch. Club Brit. Isles 4 (1917) 608.

Arundo Bambos Linnaeus Sp. Pl. (1753) 81.

Bambos arundinacea Retzius Obs. Bot. 5 (1789) 24. *Bambusa arundinacea* Willdenow Sp. Pl. 2 (1799) 245—Holland 203.

TACCADA (Pith) p. 204.

Scaevola frutescens *(Mill.) Krause* in Engl. Pflanzenreich IV. 277 (Heft 54) (1912) 125.

Lobelia frutescens Miller Gard. Dict., ed. 8 (1768) no. 1.

Scaevola Koenigii Vahl Symb. Bot. 3 (1794) 36—Holland 204.

TARO (Coco-Yam, China Potato, Eddoes, Dasheen) p. 209.

Colocasia esculenta *(Linn.) Schott* in Schott & Endlicher Meletem. Bot. 1 (1832) 18.

Arum esculentum Linnaeus Sp. Pl. (1753) 965.

Arum Colocasia Linnaeus Sp. Pl. (1753) 965.

Colocasia antiquorum Schott in Schott & Endlicher Meletem. Bot. 1 (1832) 18—Holland 35, 209.

Colocasia antiquorum Schott var. *esculenta* Schott Syn. Aroid. (1856) 42.

Following Schott most authors have considered the Taro to be a variety of the polymorphic species *Colocasia antiquorum*. However, it is not permissible under the Rules to reduce an older specific name to varietal rank under a species of later date of publication. Consequently *Colocasia esculenta* must be taken up for the species, while *C. antiquorum* is reduced to varietal status.

TONG-PANG-CHONG (Root) p. 217.

Rhinacanthus nasutus *(Linn.) Kurz* in Journ. Asiat. Soc. Bengal 39, pt. 2 (1870) 79.

Justicia nasuta Linnaeus Sp. Pl. (1753) 16.

Rhinacanthus communis Nees in Wallich Pl. Asiat. Rar. 3 (1832) 109—Holland 217.

Toowomba Canary Grass p. 218.

Phalaris tuberosa *Linn.* var. **stenoptera** *(Hack.) Hitchcock* in Journ. Wash. Acad. Sci. 24 (1934) 292.

Phalaris stenoptera Hackel in Fedde Repert. 5 (1908) 333.

"*Phalaris bulbosa*" Holland 218.

Trincomali (Wood) p. 222.

Berrya cordifolia *(Willd.) Burret* in Notizbl. Bot. Gart. Berlin 9 (1926) 606.

Espera cordifolia Willdenow in Neue Schrift. Ges. Naturf. Freunde Berlin 3 (1801) 450.

Berrya Ammonilla Roxburgh Hort. Beng. (1814) 42—Holland 222.

Tuba (Derris Root) p. 224.

Derris trifoliata *Loureiro* Fl. Cochinch. (1790) 433.

Robinia uliginosa Roxburgh ex Willdenow Sp. Pl. 3 (1803) 1133.

Derris uliginosa Bentham in Miquel Pl. Jungh. (1852) 252—Holland 224.

Tylophora (Leaves) p. 229.

Tylophora indica *(Burm.f.) Merrill* in Philipp. Journ. Sci. 19 (1921) 373.

Cynanchum indicum Burmann filius Fl. Ind. (1768) 70.

Asclepias asthmatica Linnaeus filius Suppl. (1781) 171.

Tylophora asthmatica Wight & Arnott in Wight Contrib. Bot. Ind. (1834) 51—Holland 229.

Vanilla (Orchid pods) p. 232.

Vanilla fragrans *(Salisb.) Ames* in Sched. Orch. 7 (1924) 36.

Myrobroma fragrans Salisbury Parad. Lond. (1807) t. 82, excl. synon.
Vanilla planifolia Andrews Bot. Repos. 8 (1808) t. 538—Holland 232.

VELVET BEAN (Lyon) p. 235, under Velvet Bean (Florida).

Mucuna cochinchinensis *(Lour.) A. Chevalier* in Bull. Agric. Inst. Sci. Saigon 1 (1919) 91.

Marcanthus cochinchinensis Loureiro Fl. Cochinch. (1790) 461.
Carpopogon niveum Roxburgh Hort. Beng. (1814) 54.
Mucuna nivea DeCandolle Prodr. 2 (1825) 406—Holland 235.
Mucuna Lyonii Merrill in Philipp. Journ. Sci. 1 (1906) Suppl. 197.

WAMPI (Fruit) p. 241.

Clausena Lansium *(Lour.) Skeels* in U.S. Dept. Agric. Bur. Pl. Ind. Bull. 168 (1909) 31.

Quinaria Lansium Loureiro Fl. Cochinch. (1790) 272.
Cookia Wampi Blanco Fl. Filip. (1837) 358.
Clausena Wampi Oliver in Journ. Linn. Soc. Bot. 5 (1861) Suppl. 2, 34—Holland 241.

WATER HYACINTH p. 242.

Eichhornia crassipes *(Mart.) Solms-Laubach* in DeCandolle Monogr. Phan. 4 (1883) 527.

Pontederia crassipes Martius Nov. Gen. et Sp. 1 (1824) 9.
Eichhornia speciosa Kunth Enum. Pl. 4 (1843) 131—Holland 242.

WILD TAMARIND (Wood) p. 247.

Lysiloma bahamensis *Bentham* in Hooker London Journ. Bot. 3 (1844) 82.

Lysiloma latisiliqua A. Gray in Sauv. Anales Acad. Habana 5 (1869) 406 *(nomen nudum)*—Holland 247.

WINTER SWEET p. 250.

Chimonanthus praecox *(Linn.) Link* Enum. Pl. Hort. Berol. 2 (1822) 66.

Calycanthus praecox Linnaeus Sp. Pl., ed. 2 (1762) 718.

Chimonanthus fragrans Lindley in Bot. Reg. 6 (1820) sub t. 451—Holland 250.

WOOL TREE (Cork or Down Tree) p. 257. See Balsa Wood.

WURRUS (Wars or Waras Dye) p. 258.

Flemingia macrophylla *(Willd.) O. Kuntze ex Prain* in Journ. Asiat. Soc. Bengal 66, pt. 2 (1897) 440, *in nota.*

Crotalaria macrophylla Willdenow Sp. Pl. 3 (1803) 982.

Flemingia congesta Roxburgh ex Aiton Hort. Kew., ed. 2, 4 (1812) 349—Holland 258.

YELLOW WOOD (of the United States) p. 262.

Cladrastis lutea *(Michx.f.) K. Koch* Dendrol. 1 (1869) 6.

Virgilia lutea Michaux filius Arb. Am. 3 (1813) 266, t. 111.

Cladrastis tinctoria Rafinesque Neogenyt. (1825) 1—Holland 262.

YUCA (Root) p. 264. See Cassava.

NOMENCLATORIAL NOTES. X

BY

CHARLES SCHWEINFURTH

Pleurothallis Pfavii *Reichenbach filius* in Flora 69 (1886) 555.

Masdevallia platyrachis Rolfe in Gard. Chron., ser. 3, 4 (1888) 178.

Pleurothallis platyrhachis Rolfe in Journ. Bot. 28 (1890) 136—Hooker filius in Bot. Mag. 116 (1890) t. 7129.

Kraenzlinella platyrachis Rolfe in Orch. Rev. 23 (1915) 326.

Judging from the description and a copy with color of Reichenbach's type of *Pleurothallis Pfavii* in Vienna, this name should include the concept described as *Masdevallia platyrachis*. The only discrepancies between the concepts occur in the slightly larger leaves and flowers of *P. Pfavii* with the apparent absence of the fleshy callus at the base of the column which is ascribed to *P. platyrachis*.

Although previously recorded only from Costa Rica, *Pleurothallis Pfavii* is now reported from Mexico. One of these specimens shows an incomplete raceme that bears fourteen floral bracts.

MEXICO: Mt. Madre Vieja, State of Chiapas, at 1000 meters altitude, "Flor aurantius; corticalis," June 1938, *E. Matuda 2533*.

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THE NOMENCLATURE OF THE TARO AND ITS VARIETIES

BY
ALBERT F. HILL

THE TARO, one of the oldest of cultivated plants, like other species of great antiquity has become widespread and exceedingly variable during its long history. Numerous varieties and hundreds of horticultural races have been developed under cultivation and these have received little or no systematic attention. This is particularly true in the Pacific Islands where taro constitutes one of the staple foods of the native peoples and each island or group of islands has developed its own independent races. Moreover, a difference of opinion exists among systematic botanists as to the number of species involved in this large assemblage of plants known variously as taros, dasheens, eddoes, coco-yams, malangas, tanyahs, culcas, elephant ears, Chinese potatoes and many other vernacular names. Although much remains to be done before the true relationships can be cleared up, certain general facts are available.

In the Species Plantarum (1753) Linnaeus described two types of taro to which he gave the names *Arum Colocasia* and *Arum esculentum*. In 1832 Schott (in Schott and Endlicher Meletemata Botanica) established the genus *Colocasia* and transferred to it the two Linnaean species as *Colocasia antiquorum* and *C. esculenta* respec-

tively. Schott also included in his new genus *C. acris* based on *Calladium acre* which Robert Brown had described in 1810.

Kunth in his Enumeratio Pl. (1841) cites these three species under *Colocasia* and adds a fourth, *C. nymphaeifolia* based on *Caladium nymphaeaefolium* Ventenat, described in 1800.

In 1854, Schott published *Colocasia Fontanesii*, which had originally been described by Desfontaines in 1829 as *Arum colocasioides*. Also in 1754, C. Koch and Sello described a sixth species, *Colocasia euchlora*.

In 1856, Schott published his Synopsis Aroidearum which reflected a change in the author's concept of the taro problem. Apparently he had come to feel that only a single polymorphic species was involved for he cites but one species, *Colocasia antiquorum*, and reduces the others to varietal rank. The same situation applies in Schott's Prodromus (1860).

In 1879, Engler's monograph of the aroids (in De Candolle Monographia Phanerogamia) appeared. In this work the author likewise considers the taro as a single polymorphic species, *Colocasia antiquorum*. However, in addition to Schott's five varieties, Engler recognized a variety *typica* and a variety *illustris* (based on *Alocasia illustris* Bull) which had been published in 1873.

In 1920, Engler and Krause monographed the group for the Pflanzenreich and continued to maintain *Colocasia antiquorum* for the taro aggregate. In addition to the seven varieties of Engler's earlier work (*typica*, *euchlora*, *Fontanesii*, *illustris*, *esculenta*, *nymphaeifolia* and *acris*) the authors included the variety *aquatilis* which Hasskarl had described in 1848, and published a new variety *globulifera*, based on the dasheen of the West Indies and of the southern United States.

In general, botanical literature from 1860 to 1900

followed the lead of Schott and Engler and we find *Colocasia antiquorum* used more or less indiscriminately for the taro and its several varieties. There has been, however, an increasing tendency, particularly in America, to recognize at least *Colocasia esculenta* as a distinct species. It is not the purpose of this paper to discuss the relative merits of these viewpoints, but rather to point out certain nomenclatorial changes which must be adopted by those botanists who continue to consider the taro and its varieties as belonging to a single composite species.

The adoption of the International Rules of Botanical Nomenclature brought into force a rule which makes it inadmissible to reduce an older specific name to varietal rank under a species of a later date of publication. Consequently Schott's reduction of *Colocasia esculenta* (1753) to varietal rank under *Colocasia antiquorum* (1832) is illegal under the Rules and cannot be maintained. The conditions must be reversed with *C. esculenta* becoming the name for the polymorphic species, which includes a variety *antiquorum*. In recent years several systematic botanists have made this change and *Colocasia esculenta* is becoming more and more frequent in literature as the name for the taro aggregate.

This reversal of names necessitates several new combinations in so far as the varieties are concerned, only a few of which have apparently been made. It seems advisable to publish these new combinations under the polymorphic species *Colocasia esculenta*, even though most American botanists hold a different opinion in regard to the taxonomic status of several of these variants.

Colocasia esculenta *(Linn.) Schott* in Schott & Endlicher Meletem. Bot. 1 (1832) 18—Urban Symb. Antill. 4 (1903) 135—Merrill Fl. Manila (1912) 134; Interpret. Herb. Amb. (1917) 131; Enum. Philipp. Flow.

Pl. 1 (1922) 180; Comment. Lour. Fl. Cochinch. (1935) 98—Burkill Dict. Econ. Prodr. Malay Penins. 1 (1935) 638—Dalziell & Hutchinson Fl. West Trop. Afr. 2 (1936) 361.

var. **typica**

Arum esculentum Linnaeus Sp. Pl. (1753) 965.
Caladium esculentum Ventenat Descr. Pl. Nouv. Jard. Cels. (1800) sub t. 30—Willdenow Sp. Pl. 4 (1805) 489.
Colocasia esculenta Schott in Schott & Endlicher Meletem. Bot. 1 (1832) 18—Kunth Enum. Pl. 3 (1841) 37.
Colocasia antiquorum Schott var. *esculenta* Schott Syn. Aroid. (1856) 42; Prodr. Syst. Aroid. (1860) 140—Engler in DC. Monogr. Phan. 2 (1879) 492—Engler & Krause in Engl. Pflanzenreich IV. 23E (Heft 71) (1920) 67.

var. **nymphaeifolia** *(Vent.) A.F.Hill comb. nov.*

Caladium nymphaeaefolium Ventenat Descr. Pl. Nouv. Jard. Cels. (1800) sub t. 30—Willdenow Sp. Pl. 4 (1805) 488.
Arum nymphaeifolium Roxburgh Fl. Ind. 3 (1832) 495.
Colocasia nymphaeifolia Kunth Enum. Pl. 3 (1841) 37.
Colocasia antiquorum Schott var. *nymphaeifolia* Schott Syn. Aroid. (1856) 42; Prodr. Syst. Aroid. (1860) 140—Engler in DC. Monogr. Phan. 2 (1879) 492—Engler & Krause in Engl. Pflanzenreich IV. 23E (Heft 71) (1920) 67.

var. **globulifera** *(Engl. & Krause) Young* in U.S. Dept. Agric. Dept. Bull. 1247 (1924) 8, *in adnot.*

Colocasia antiquorum Schott var. *globulifera* Engler & Krause in Engl. Pflanzenreich IV. 23E (Heft 71) (1920) 68.

var. **aquatilis** *Hasskarl* Pl. Jav. Rar. (1848) 150.
Colocasia antiquorum Schott var. *aquatilis* Engler & Krause (as *C. antiquorum* var. *aquatilis* Hasskarl) in Engl. Pflanzenreich IV. 23E (Heft 71) (1920) 68.

var. **acris** *(R.Br.) A.F.Hill comb. nov.*
Calladium acre R. Brown Prodr. Fl. Nov. Holl. (1810) 336.
Colocasia acris Schott in Schott & Endlicher Meletem. Bot. 1 (1832) 18.
Colocasia antiquorum Schott var. *acris* Schott Syn. Aroid. (1856) 42; Prodr. Syst. Aroid. (1860) 140—Engler in DC. Monogr. Phan. 2 (1879) 492—Engler & Krause in Engl. Pflanzenreich IV. 23E (Heft 71) (1920) 68.

var. **antiquorum** *(Schott) Hubbard & Rehder* in Bot. Mus. Leafl. Harv. Univ. 1, no. 1 (1932) 5.

Arum Colocasia Linnaeus Sp. Pl. (1753) 965.
Colocasia antiquorum Schott in Schott & Endlicher Meletem. Bot. 1 (1832) 18; Syn. Aroid. (1856) 41; Prodr. Syst. Aroid. (1860) 138—Kunth Enum. Pl. 3 (1841) 37—Engler in DC. Monogr. Phan. 2 (1879) 491—Hooker filius in Bot. Mag. 120 (1894) t. 7364—Engler & Krause in Engl. Pflanzenreich IV. 23E (Heft 71) (1920) 65.
Caladium Colocasia W. F. Wight in Contrib. U. S. Nat. Herb. 9 (1905) 208.

var. **euchlora** *(C. Koch & Sello) A. F. Hill comb. nov.*
Colocasia euchlora C. Koch & Sello in Ind. Sem. Hort. Bot. Berol. (1854) App. 4.

Colocasia antiquorum Schott var. *euchlora* Schott Syn. Aroid. (1856) 42; Prodr. Syst. Aroid. (1860) 140—Engler in DC. Monogr. Phan. 2 (1879) 491—Engler & Krause in Engl. Pflanzenreich IV. 23E (Heft 71) (1920) 67.

var. **Fontanesii** *(Schott) A.F.Hill comb. nov.*

Arum colocasioides Desfontaines Cat. Pl. Hort. Reg. Paris, ed. 3 (1829) 7, 385.
Caladium colocasioides Hort. Par. ex Brongniart in Nouv. Ann. Mus. Paris 3 (1834) 156—Kunth Enum. Pl. 3 (1841) 43.
Colocasia Fontanesii Schott in Oest. Bot. Wochenbl. 4 (1854) 409.
Colocasia antiquorum Schott var. *Fontanesii* Schott Syn. Aroid. (1856) 42; Prodr. Syst. Aroid. (1860) 140—Engler in DC. Monogr. Phan. 2 (1879) 491—Hooker filius in Bot. Mag. 126 (1900) t. 7732—Engler & Krause in Engl. Pflanzenreich IV. 23E (Heft 71) (1920) 67.
Caladium violaceum Hort. ex Engler in DC. Monogr. Phan. 2 (1879) 492, *in synon.*
Colocasia violacea Hort. ex Hooker filius in Bot. Mag. 126 (1900) t. 7732, *in synon.*

var. **illustris** *(Bull) A.F.Hill comb. nov.*

Alocasia illustris Bull Cat. (1873) 4; in Flor. Mag. (1874) t. 107.
Colocasia antiquorum Schott var. *illustris* Engler in DC. Monogr. Phan. 2 (1879) 492—Engler & Krause in Engl. Pflanzenreich IV. 23E (Heft 71) (1920) 67.

NOTES ON THE GENUS ALEURITES

BY

LOUIS CUTTER WHEELER

THE GENUS *Aleurites* J. R. & G. Forster (Char. Gen. Pl. (1776) 111, t. 56) being of considerable and increasing economic importance, merits careful taxonomic consideration. In the search for the best kinds of Aleurites for cultivation even taxonomically trivial variations may be important. At present even the species are poorly defined taxonomically, though they may be sufficiently distinct biologically. Minor variations have been given almost no consideration. The reason for this unfortunate situation is not indolence of systematists, but rather the paucity of specimens in herbaria, due to the general remoteness from systematic institutions of the native habitat, and lack of funds. If the last obstacle were removed, the other difficulties would soon be remedied.

The more important papers dealing with the classification of the genus are those of Hemsley 1906 and 1914, Langeron 1902, J. Mueller 1866, Pax 1910, Pax & Hoffmann 1919 and 1931. These papers are all well-known except Langeron's. Unfortunately his dissertation has been generally overlooked, perhaps because he described no new species. However, he did describe the following varieties of *Aleurites moluccana* (L.) Willd. :

I. Var. α *Rockinghamensis* Baillon ex Langeron, p. 33 (1902). The type, in the herbarium of the Muséum d'Histoire Naturelle, Paris, was collected in Australia. This variety is said to differ from the species in the angle at which the secondary nerves depart from the primary nerves, and in the more compact inflorescence.

II. Var. β *angustifolia* (Vieillard) Langeron p. 34, fig. 8 (1902); based on *Aleurites angustifolia* Vieillard in Ann. Sci. Nat. Bot. ser. 4, 16 (1862) 60. This plant has,

at least in the specimen figured by Langeron, lanceolate leaves. It occurs in New Caledonia. The nomenclatural basis of Langeron's combination is unintentionally but nevertheless thoroughly confused due to the fact that Langeron, p. 34, cites "Var. β—*angustifolia* Vieillard (pro specie)" which would have been fairly clear even though in poor form if he had not proceeded to make the following statement on the next page: "Cette plante est très probablement celle que Vieillard a décrite sous le nom d'*A. angustifolia* dans sa note sur quelques plantes intéressantes de la Nouvelle-Calédonie et provenant de Pnebo-[sic, error for Puébo] Balade." This is not a mere pedantic quibble as to whether Langeron were describing a *new* variety or merely reducing Vieillard's species to a variety. It involves the fundamental biological question of whether the two names are based on the same type and perforce synonymous or whether they are based on different types and in consequence are perhaps biologically different. While I have accepted Langeron's variety as being based on Vieillard's species, ultimately it would be enlightening to examine the specimens at Paris in order to see exactly what Langeron had in mind.

Langeron, in his vague reference to the article in which Vieillard published *Aleurites angustifolia*, gave the title of a paper of Vieillard published in the Bulletin de la Société Linnéenne de Normandie 10 (1866)--which was four years later than the correct reference given above. Furthermore, the article of 1866 did not mention *Aleurites*. *A. angustifolia* has been overlooked by Index Kewensis and all authors except Langeron. O. Stapf (Index Londinensis 1 (1929) 119) lists Langeron's illustrations of vars. *angustifolia* and *circulata*.

III. Var. γ *circulata* Langeron, p. 35, fig. 7 (1902). The type, collected by *Balansa* in New Caledonia, is in the Herb. Mus. Paris. The leaves are essentially orbic-

ular. This, like the rest of Langeron's varieties, has been overlooked by authors.

The type species of *Aleurites* is *A. triloba* J. & G. Forster Char. Gen. Pl. (1776) 112, t. 56. This species is synonymous with *A. moluccana* (L.) Willd. Sp. Pl. ed. 4, 4 (1805) 590; based on *Jatropha moluccana* L. Sp. Pl. 2 (1753) 1006—*Aleurites integrifolia* Vieillard (in Ann. Sci. Nat. Bot. ser. 4, 16 (1862) 59) was published as a synonym of *A. triloba* Forster.

From a superficial examination of the synonymy given by Pax in Engler Pflanzenreich IV. 147 (Heft 42), 132 (1910) it would appear that *Elaeococca verrucosa* (Adr. Juss. Euphorb. Gen. Tent. (1824) 112, t. 11, fig. 35) were an earlier name for *Aleurites Fordii*. Happily *Elaeococca verrucosa* was substituted for the available name *Dryandra cordata* Thunberg. Since the name *Elaeococca verrucosa* was superfluous when published, it is not to be considered for purposes of priority. Likewise the synonymy given by Wilson (in Bull. Imp. Inst. 11 (1913) 460) makes it appear that if the seeds of *Dryandra oleifera* Lamarck (Encycl. Meth. Bot. 2 (1786) 329) were taken as typifying the species, (it is said to be a mixture of two species) it would be an earlier name for *Aleurites montana* (Lour.) Wilson (in Bull. Imp. Inst. 11 (1913) 460) based on *Vernicia montana* Loureiro Fl. Cochinch. 2 (1790) 387. However, *Dryandra oleifera* was superfluous when proposed, since it was substituted for *D. cordata* Thunberg Fl. Jap., (1784) 267. Such names are not to be considered for purposes of priority according to the provisions of the International Rules of Nomenclature, ed. 3 (1935) (Arts. 45 & 60). I have proposed (in Amer. Midl. Nat. 21 (1939) 529) that such names be forever excluded from use. It appears that the "imprioriable" names of Furtado (in Chronica Botanica 5 (1939) 214-215) are in the same category.

Langeron gives a map of the geographical distribution of the genus *Aleurites*. One error, which was not his fault, is to be noted. *A. moluccana* is indicated as occurring in Lower California. The basis of this error is a specimen in the Berlin Herbarium collected by *Deppe* supposedly in California. Pax cited the same collection in Engler Pflanzenreich IV. 147 (Heft 42) (1910) 131. As noted by I. M. Johnston (in Contrib. Gray Herb. 68 (1923) 88) *A. moluccana* does not occur in either Upper or Lower California but is common in Hawaii which is the probable source of Deppe's specimen. A parallel case is that of *Euphorbia Deppeana* Boissier. The type, which I have examined, purports to have come from California but is a member of the Hawaiian subsection *Gymnadeniae*. Since no further collections of this species have appeared from Lower California, it seems fairly well demonstrated that the data were erroneous on some of Deppe's specimens.

BIBLIOGRAPHY

Hemsley, W. B. 1906. Revision of the synonymy of the species of Aleurites. Kew Bull. 1906: 119-121.

——. 1914. The wood-oil trees of China and Japan. Kew Bull. 1914: 1-4.

Langeron, Maurice. 1902. Le genre Aleurites Forst. (Euphorbiacées), systematique—anatomie—pharmacologie. 160 pp., 52 figs. Paris. L. Boyer.

Müller, J. (Arg.) 1866. Aleurites in DC. Prodr. 15, pt. 2: 722-724.

Pax, F. 1910. Aleurites in Euphorbiaceae—Jatropheae in Engler Pflanzenreich IV. 147 (Heft 42): 128-133.

——, & K. Hoffmann. 1919. Aleurites in Euphorbiaceae—Additamentum VI in Engler Pflanzenreich IV. 147 (14): 8.

——, ——. 1931. Aleurites in Engler & Prantl, Nat. Pflanzenfamilien, 2 Aufl., 19c: 99-100.

Wilson, Ernest H. 1913. The "Wood-oil" trees of China and Japan. Bull. Imp. Inst. 11: 441-461.

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PLANTAE MEXICANAE III

BY

RICHARD EVANS SCHULTES

A SIGNIFICANT VARIETY OF LIPARIS VEXILLIFERA FROM OAXACA

A LARGE COLLECTION of an interesting orchid made in Oaxaca proves to be *Sturmia arnoglossophylla* Reichb.f. An examination of a drawing by Blanche Ames (in Herb. Ames) of the type of *Sturmia arnoglossophylla* (in Herb. Reichenbach Orch. No. 39783) together with the original description convinces me that this species falls within the range of floral variation exhibited by *Liparis vexillifera* (La Llave & Lex.) Cogn. Furthermore, this species is comparable to the specimens collected by Schultes and Reko in Oaxaca in having two broadly elliptic leaves and similar floral structure. Reichenbach's specimen, however, differs from the Oaxacan collection in being only about half as large and in having the sepals narrower and more linear. It is probably a young plant, for the inflorescence is immature at the apex.

The reduction of Reichenbach's species to varietal rank is based on the study of Mrs. Ames' drawing of the Reichenbach sheet in Vienna and on a comparison of this drawing with the Oaxacan collection of Schultes and Reko.

Liparis vexillifera *(La Llave & Lex.) Cogniaux* var. **arnoglossophylla** *(Reichb.f.) R.E.Schultes comb. nov.*

Sturmia arnoglossophylla Reichenbach filius in Bonplandia 4 (1856) 217.
Liparis arnoglossophylla "Rchb.f." ex Hemsley in Godman & Salvin Biol. Centr.-Am. Bot. 3 (1883) 212.

Plant similar to *Liparis vexillifera*, but bifoliate. Leaves subequal, large, broadly elliptic, acuminate, very membranaceous, 9–11 cm. long, 5–7 cm. wide. Inflorescence a loose raceme. Floral bracts 5–7 mm. long, much shorter than the ovary. Sepals similar. Dorsal sepal 10 mm. long and 2 mm. wide. Lateral sepals 12 mm. long, 2 mm. wide. Petals linear, 10 mm. long, shorter than the lateral sepals. Labellum more or less acute, 14 mm. long, 8 mm. wide.

Whereas *Liparis vexillifera* appears always to have a single more or less coriaceous leaf, the variety is strikingly different in having two large, extremely membranaceous and much broader leaves. The leaves of the variety are always of slightly different size. *Liparis vexillifera* occurs commonly, but not exclusively, in somewhat dry open habitats, while *L. vexillifera* var. *arnoglossophylla* inhabits the rich, damp floor of cool dark rain-forests at high altitudes. The difference in number, texture and size of leaves of the two plants may be correlated with the usual habitat differences.

Florally, there are minor differences shown by the variety. The inflorescence appears to be more loosely racemose, while the relative size of the sepals and petals is slightly different. The lip is acute.

In *Liparis vexillifera* var. *arnoglossophylla* the lip is more or less translucent, of a pale green color. The sepals and petals are predominantly of the same color, but become a bluish-black toward the centre of the flower. The column is bright orange.

Mexico: "New Spain," Herb. Pavon (Type); terrestrial, on rich damp floor of a cool dark rain-forest, slopes of Cerro del Fraile, Huautla de Jiménez, Oaxaca, at about 7500 feet altitude, August 8, 1938, *Richard Evans Schultes and Blas Pablo Reko 394* (in Herb. Ames No. 55479).

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BOTANICAL MUSEUM LEAFLETS
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THE FOSSIL FLORA OF IOWA COAL BALLS

I. DISCOVERY AND OCCURRENCE

BY

WILLIAM C. DARRAH

COAL BALLS are fossiliferous mineral nodules which, because they occur occasionally in coal deposits, are of special interest to both botanists and geologists. Usually these nodular structures are composed of calcite or dolomite, more rarely pyrite, but they are always complex mixtures of inorganic substances. Well-preserved fragments of plants are often found in coal balls and these fossils are the chief source of information concerning the anatomy of Carboniferous plants. The plant morphologist is familiar with a score of extinct plants such as *Lepidodendron* and *Calamites* which have become fundamental to an understanding of our concepts of phylogeny and evolution, yet he is prone to overlook the fact that we owe our knowledge of them largely to petrifactions in coal balls.

A century has passed since Henry Witham of Lartington published his *Internal Structure of Fossil Vegetables found in the Carboniferous and Oolitic Deposits of Great Britain*, which although it included notes on only twelve species, was the first carefully executed histological work on fossil plants. Now the internal morphology of more than two hundred Paleozoic plants has been described, but not more than twenty of these plants are

known with a degree of completeness. During the middle of the nineteenth century Binney, Carruthers, and Williamson began a brilliant period of investigation on British coal balls which culminated in the fruitful researches of Scott, Maslen, Benson, and their students.

Coal balls have been found in England, Holland, Belgium, France, Germany, Moravia, Russia, Australia, and the United States. They have been reported also in China, but so far as I am aware, no plant forms have been described from Chinese specimens.

The first discovery of coal balls in America was announced nearly twenty years ago when the late Doctor A. C. Noé recognized them in Illinois. Subsequently he located coal balls in Indiana and Kentucky, and reported pyritized nodules from Iowa. Plant remains were observed in all of these, but no comprehensive report on their botanical content has ever been published. Noé made several contributions to our knowledge of their plants in enumerations of species, the number of entries increasing rapidly with encouraging variety (1925, 1931, 1931). However, the detailed descriptions he left to his students, notably Hoskins, Graham (1934), Reed, Krick, and Schopf. Recently Arnold and Steidtmann have also made additions to the flora of Illinois coal balls.

Two years ago, Mr. Frederick Oliver Thompson of Des Moines, Iowa, began a diligent search for new occurrences of coal balls and his efforts were rewarded by their discovery at four localities in the Des Moines Series of the Pennsylvanian deposits of Iowa. He has transmitted to the Botanical Museum of Harvard University more than 1800 nodules varying in their diameters from 3 to 22 inches.

A person unfamiliar with the study of structurally preserved fossil plants is frequently unaware of the difficulties which attend the investigation of paleobotanical

remains and of the quantity of material necessary for an adequate description. From the very beginning of a problem the investigator is faced by the fragmentary nature of the plant parts and the painstaking "piecing together" of small fragments. Even though one can scarcely doubt the attachment of a particular seed to a twig or a given leaf to a stem, organic connection, that is actual union of parts, must be observed before attachment is proven. As a result of this necessity for caution, numerous generic and specific names must be applied to parts of a single biological species. If an investigation be made of hundreds of examples of the same kind, the fragments which show attachments, such as small branches on larger portions of the axis, inflorescences borne upon twigs, and the like, may ultimately yield noteworthy results. However, much restraint and caution must be used in these problems.

We have found, accidentally, a method which has revealed a surprising number of cases of organic union of parts: sporangia on fern fronds, spores in sporangia, ovules within inflorescences, fronds attached to petioles, and pollen-grains in staminate strobili. By the same method we have observed impressions of various fossil plants in the coal balls as well as the mineralized portions showing histological detail. Thus the Iowa coal ball flora contains nearly a dozen species known both externally and internally.

Within recent years some progress has been made in this direction upon Mesozoic floras by Harris, Thomas, and Florin, but little upon Paleozoic, though Florin, Walton, Hartung, and the writer have made small beginnings.

Method of Study

Each coal ball was split into smaller fragments with a sledge-hammer. It was found that each coal ball, with

very rare exceptions, broke in a plane parallel to the longest axis and approximately at right angles to the shortest axis. These planes of weakness would seem to be "bedding planes." Although the balls are nodular, they are not concretions—that is, formed by concentric accretions of sediment or crystalline substance. The whole nodule is formed at the same time and formed congenerically with the fossil it encloses.

The ball was then broken into smaller fragments somewhat smaller than a man's fist. By means of a lapidary's saw, small blocks containing selected fossilized plant structures were cut, and later ground upon a revolving lap with carborundum grit. Serial nitrocellulose peels were then made from all desirable materials. More than 3500 plant specimens have been preliminarily identified and from 3 to 40 peels have been prepared from each specimen. To date, more than 38000 microscopic slides have been made.

The first stage in the study of this extensive material has been concerned with a rapid and cursory survey of the flora—cursory in the sense that the histological details of the forms have not been described or observed closely. The microscopic slides represent sixty-two to sixty-six species most of which are new. The species are broadly defined and the number now recognized is much less than the original estimate; for example, there is only one *Mesoxylon*, whereas we had tentatively separated four or five. The task before us is, of course, the description of each species in as great detail as material permits, with "serial sections" of all essential parts.

Plan of the Work

This paper has been written as an introduction to a series of contributions concerning the taxonomy, histology, and morphology of the significant members of the

flora contained in Iowa coal balls. Naturally the study of a flora containing more than sixty species, most of which appear to be either undescribed or very imperfectly known, will require a number of years for investigation. It is hoped, therefore, that the description of each plant species, or group of related species, will be published when its study has been completed. The descriptions and illustrations of three forms in this flora are now awaiting publication: the fructification of a new *Botryopteris*, the embryo of a *Cordaicarpus*, and a new seed of the *Mazocarpon* type.

Plant Content

The Iowa coal ball flora differs from all other described coal ball floras in that it is essentially gymnospermous rather than pteridophytic. In order of abundance the plant groups represented are: *Cordaitales*, *Pteridospermae*, *Filicales*, *Sphenophyllales*, *Calamitales*, and *Lepidodendrales*.

Cordaitales

The form-genus *Cordaites* was originally proposed for strap-shaped linear leaves belonging to large arborescent cone-bearing gymnosperms. There are several thousands of fragments belonging to probably a single biological species or possibly to two species. Most numerous of these are specimens of wood of the *Mesoxylon* type. The wood is found in fragments ranging in size from small twigs to a stump measuring nineteen inches in diameter. There is a large discoid pith (the so-called *Artisia* structure). Next in abundance are the leaves which have not yet been identified. Both the impression and the histological structure of these foliar organs have been observed. Root fragments are frequently found, but their connection is only implied by association. The seeds known as

Cordaicarpus, are very numerous, more than one hundred individual examples have been found. Of this number eight have well preserved dicotyledonous embryos. These are the first known Paleozoic embryos. There are nearly three hundred microsporangiate strobili and, curiously, only six megasporangiate strobili. The polliniferous inflorescences contain winged pollen-grains each with a multicellular gametophyte of approximately twenty to thirty cells. In addition there are specimens of vegetative buds and enrolled leaves. If these detached parts can subsequently be demonstrated to belong to a single species, it will be one of the most completely known Carboniferous plants.

Pteridospermae

The most abundant seed-fern stem type occurring in the Iowa coal balls is a tristelic species of *Medullosa* which is most probably identical with *Medullosa Noei* Steidtmann, which in turn belongs to the *Medullosa anglica* group. Large petioles, as well as many smaller ones, have been prepared for detailed study. Leaves of *Neuropteris Scheuchzeri* Hoffman, *Neuropteris rarinervis* Bunbury, and *Linopteris* cf. *obliqua* are abundantly preserved both as impressions and petrifactions. There are several little known fructifications (one a *Telangium*) which occur in the flora. Eight nominal species of detached seeds of the *Lagenostoma*, *Rhabdocarpus*, and *Trigonocarpus* types occur sparingly, as well as a variety of other undescribed forms. Seeds of the *Lagenostoma* type are rare.

Filicales

By delicate manipulation with needles and chisels we have been able to expose impressions of two species of *Pecopteris* foliage bearing sori; one an *Asterotheca* and

the other a probable *Ptychocarpus*. Detached sporangia are very numerous in all of the coal balls. Petioles are abundant and the following forms are well represented: three (possibly only two) species of *Botryopteris*, at least two species of *Etapteris*, one *Anachoropteris*, one *Ankyropteris*, an actinostelic fern which is apparently new, and several complex *Zygopteridaceae*. Fine specimens of a polystichous *Psaronius* are moderately abundant. One species of *Botryopteris* is known from the fructification as well as the petiole. This remarkable form, represented in the collections by three specimens, has a great globose cluster of sporangia borne terminally upon the frond.

Sphenopsida

Sphenophyllum, stems and strobili (the *Sphenophyllum Dawsoni* type) are found occasionally. The *Calamitales* are represented in the collections by only a few specimens of the *Arthropitys communis* type, a beautiful *Macrostachya*, and two specimens of a small homosporous *Calamostachys*. These two forms of strobili contain well-preserved spores.

Lycopsida

The Lycopsida seem to have been very rare. Only two specimens of a siphonostelic *Lepidodendron* with a mixed pith of the *Lepidodendron selaginoides* type have been found. In addition, however, there are occasional seed-like structures referable to *Mazocarpon* and *Lepidocarpon*, a megasporophyll bearing sixteen large megaspores (cf. *Lepidophyllum missouriense* White), and a single needle-like leaf of *Sigillaria*.

It is apparent then, that the Lycopsida and Sphenopsida play a very minor rôle in this flora. That they are meagerly represented is evidenced both by the fewness of the species, and, more convincingly, by the scarcity of

individuals. That this is not merely an apparent rarity is indicated by the large number of specimens which have been studied.

Discussion

The well-known Middle Coal Measures coal ball flora of England is a *Lyginopteris—Lepidodendron—Calamites* flora with *Mesoxylon*, *Medullosa*, and filicineans being satellitic types. The same association occurs in Holland and Belgium, but in the latter *Lyginopteris* seems to be more rare. We have studied nearly a hundred nodules from Belgium and several score from England and Holland, and our results on this small number agree with those noted in Hirmer's resumé (1928).

Judging from the enumerations of species found in Illinois coal balls, it would appear that the flora is very similar to European coal ball floras except that it includes also geologically younger elements, notably the so-called Stephanian fern types.

The Iowa coal ball association is *Cordaites—Medullosa—Psaronius*, with other ferns being complementary elements.

Nature of the coal balls

Analysis

The histological detail preserved in these Iowa coal balls, although not so excellent as in many types of silicified nodules, is so good that it is necessary to consider the unusual nature of the petrifactions.

The coal balls are highly pyritic, so much so that the specific gravity averages about 3.5 and the luster of a cut surface is metallic. In order to verify the optical identification of the ingredients in the matrix, a sample was submitted to F. A. Gonyer of the Geological Museum of Harvard University. He reports the following analysis:

Sulphur	(S)	32.27
Iron	(Fe)	27.12
Iron Oxide	(Fe_2O_3)	.76
Calcium Oxide	(CaO)	19.56
Carbon Dioxide	(CO_2)	14.87
Water	(H_2O+)	1.47
Water	(H_2O-)	none
Silica	(SiO_2)	.70
Soda	(Na_2O)	.17
Organic Matter		3.10
		100.02

It is noteworthy that no alumina (Al_2O_3) nor magnesia (MgO) has been found in the analysis. This is the more significant because there is usually sufficient dolomite ($CaCO_3 . Mg\ CO_3$) present in a coal ball to warrant the name "dolomitknollen." The pyrite, FeS_2, amounts to nearly 60% of the total, and the Calcite, $CaCO_3$, slightly more than 34%. The organic component is unexpectedly great and stands out in contrast with the 1.8% to 2.5% average reported from typical English coal balls.

Stopes and Watson (1908, p. 193) have given the following analyses of three typical English coal balls:

$CaCO_3$	51.188	87.827	49.355
$MgCO_3$	42.820	6.212	39.682
$FeCO_3$	2.342	1.026	2.247
$MnCO_3$	0.521	0.853	0.597
Al_2O_3	trace	trace	———
$Ca_3P_2O_8$	0.525	trace	0.222
FeS_2	0.339	1.430	3.273
Clay	0.119	0.000	0.053
Organic matter	1.855	2.579	4.064
Free water	0.264	0.100	0.446

It is noteworthy that the "organic matter" in sample three exceeds four percent.

The small crystals of pyrite have not distorted the plant tissues during petrifaction. Study of a ground section of a coal ball reveals that the pyrite is distributed through the matrix in the spaces in and between plant fragments, not in the cells or tissues.

Almost nothing is known concerning the mode of formation of such nodules. The sulphur content, which is in the form of one or more sulphides, is proportionately higher than in the surrounding coal, and it is possible that this indicates that some organic factor associated with the complex process of decomposition is influential in their formation. Small masses of pyrite or marcasite are to be observed in nearly every coal seam, and I suspect that they owe their origin to a kindred, if not identical, process. Stopes and Watson (1908) and Feliciano (1924) agree that coal balls are formed *in situ* and found no evidence in support of the naïve hypothesis that the nodules were transported into a coal-forming environment.

Occurrence

The coal balls reported in this paper have been found in a small area west of the city of Des Moines, Iowa, traversing the boundary between Dallas and Polk Counties. The most abundant material has been collected in the Shuler Mine in Walnut Township, Dallas County, five miles west of Des Moines. The Urbandale Mine, Walnut Township, two miles west of the city limits of Des Moines, has also yielded abundant material.

It is not known whether the coal seams of the Shuler and Urbandale Mines are identical. Coal number 7 of the Shuler Mine is a seam five and one half feet thick, lying 610 feet above sea level and 387 feet beneath the surface of the ground which is at an elevation of 997 feet. The chief seam of the Urbandale Mine, that which contains nodules, varies from four and one half to five and one half

feet in thickness, lies 624 feet above sea level and 185 feet beneath the surface of the ground which has an elevation of 809 feet.

These coal seams belong to the rocks classed in the Des Moines Series of the Upper Pennsylvanian period, which is an age equivalent to the Westphalian C, perhaps to the higher (younger) Westphalian D of western Europe (Darrah 1937). It is hoped that a study of the plants in this flora will contribute data towards the more precise stratigraphy and correlation of the deposits.

There is one additional feature involved in the occurrence of the Iowa coal balls which deserves notice. All of the nodules which I have observed in place in the Shuler Mine were scattered through the upper third of the coal seam, and Mr. Markum called my attention to the fact that this is their usual position throughout those portions of the workings where coal balls have been encountered. The roof of the coal is a black shale which contains marine invertebrate fossils. Several years ago my wife and I collected many coal balls in the Werister Colliery in Liége, Belgium and we observed there that the nodules were scattered through the coal which is overlain by a marine band. Many of the Belgian and English coal balls contain fossil cephalopods. This fact has given rise to the opinion that such nodule formation is "mal de mer" of the coal bed. Coal balls are so unexpectedly irregular in their occurrence that the intimate association of marine sedimentation with coal accumulation usually observed in coal ball bearing seams is more than coincidence.

Acknowledgments

The extensive collection of coal balls made available for investigation were secured by Mr. F. O. Thompson with the generous and hearty coöperation of Mr. Henry

Shuler and Mr. John Shuler. We are indebted to these friends who together have sent to the Botanical Museum literally tons of coal balls. We wish to acknowledge also the assistance and genuine interest of Mr. Charles Bendixon, Mr. Frank Markum, and Mr. Joe Johnson. Doctor Charles Keyes and Doctor A. K. Miller have kindly furnished data on the stratigraphy of the deposits.

The work involved in sawing and grinding the nodules and in the preparation of peels and microscopic slides has been made possible in part by a liberal grant from the Milton Fund of Harvard University, and in part by gifts from Mr. Thompson. The Trustees of the Elizabeth Thompson Fund have installed grinding equipment which has been used for the past four years. To all of these we acknowledge our gratitude. A word of recognition is due to the ten students who have cheerfully labored to prepare the thousands of slides now available for study.

BIBLIOGRAPHY

Darrah, W. C., 1936: The Peel Method in Paleobotany. Bot. Mus. Leafl. Harv. Univ. Vol. 4. pp. 69-83.

Darrah, W. C., 1937: American Carboniferous Floras. Comptes Rendus 2e. Congr. Études Strat. Carb. Vol. 1. pp. 109-129.

Feliciano, J. M., 1924: The Relation of Concretions to Coal Seams. Journ. Geol. Vol. 32. pp. 230-239.

Graham, R., 1934: Pennsylvanian Flora of Illinois as revealed in Coal Balls. I. Bot. Gaz. Vol. 95. pp. 453-476; II. Bot. Gaz. Vol. 97. pp. 156-168.

Hirmer, M. 1928: Über Vorkommen und Verbreitung der Dolomitknollen und deren Flora. Comptes Rendus Congr. Études Strat. 290-312.

Noé, A. C. 1925: Coal Balls Here and Abroad. Trans. Ill. State Acad. Sci. Vol. 17. pp. 179-180.

Noé, A. C. 1931: Coal Ball Floras of Illinois. Trans. Ill. State Acad. Sci. Vol. 23. p. 429.

Noé, A. C. 1931: Review of American Coal Ball Studies. Trans. Ill. State Acad. Sci. Vol. 24. pp. 317-320.

Stopes, M. C. and Watson, D. M. S. 1908: On the present Distribution and Origin of the Calcareous Concretions in Coal Seams, known as Coal Balls. Phil. Trans. Roy. Soc. Lond. B. Vol. 200. pp. 167-218.

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ORCHID STUDIES, X

BY
LOUIS O. WILLIAMS

ORCHIDS FROM AMERICA AND ASIA

Altensteinia Rosei *(Ames) L.O.Williams comb. nov.*

Aa Rosei Ames in Proc. Biol. Soc. Wash. 35 (1922) 81.

The genus *Aa* Reichenbach filius is referable to the older *Altensteinia* Reichenbach filius. This species has not been previously transferred.

Prescottia tubulosa *(Lindl.) L. O. Williams comb. nov.*

Cranichis tubulosa Lindley Gen. & Sp. Orch. Pl. (1840) 451—Kränzlin in Arkiv för Botanik 16 (1920) 1.

Prescottia pachyrhiza Richard & Galeotti in Ann. Sci. Nat. ser. 3, 3 (1845) 31.

? Prescottia Lindeniana Richard & Galeotti in Ann. Sci. Nat. ser. 3, 3 (1845) 31.

Galeoglossum prescottioides Richard & Galeotti in Ann. Sci. Nat. ser. 3, 3 (1845) 31.

Prescottia Galeottii Reichenbach filius in Linnaea 19 (1847) 377.

A photograph of the type of *Cranichis tubulosa* and of Lindley's analytical sketch of the species leaves no

doubt that it belongs to the genus Prescottia and that it is the same as the plant commonly determined as *Prescottia pachyrhiza* Richard & Galeotti.

The record of *Prescottia Lindeniana* which is available seems to indicate that the species is referable to *P. tubulosa*, but the record is not satisfactory for certain identification.

Cheirostylis longiflora *(Reichb.f.) L.O.Williams comb. nov.*

Anecochilus longiflorus Reichenbach filius in Seemann Fl. Vit. (1868) 294.

Odontochilus longiflorus Bentham & Hooker filius ex Drake Ill. Fl. Ins. Pacif. (1886) 312—L.O.Williams in Bot. Mus. Leafl. Harv. Univ. (Orch. Fiji) 5 (1938) 112.

? Odontochilus upoluensis Kränzlin in Mitteil. Institt. Allgem. Bot. Hamb. 5 (1922) 236.

In a restudy of the generic affinity of this plant it appears that it should have been placed in the genus *Cheirostylis* because of the connate bases of the sepals and because of the form of the column.

Fiji Islands: terrestrial, dense forest, southern slope of Mount Seatura, Mbua, Vanua Levu, at 600-700 meters altitude, flowers white, April 27, 28, 1934, *Smith 1623*; terrestrial, swampy rain forest, central plateau between Wainimala and Singatoka Rivers, Wainisavulevu Divide, Taunaisali, Tholo East, Viti Levu, at 3800 feet altitude, flower white, August 18, 1937, *St. John 18372*; "Feejee Islands", 1832-42, *Wilkes U. S. South Pacific Exploring Expedition.*

Physosiphon Lansbergii *(Reichb.f.) L.O. Williams comb. nov.*

Masdevallia Lansbergii Reichenbach filius in Nederl. Kruidk. Arch. 4 (1859) 317—Kränzlin in Fedde Repert. Beihefte 34 (1925) 104.

Physosiphon Lansbergii exhibits the generic charac-

ters found in *P.tubatus* (Lodd.) Lindley, the type species of the genus Physosiphon.

VENEZUELA: Prope coloniam Tovar, 1854-5, *Fendler 1369* (Gray Herbarium); epiphytic on palm trunks in humid forest, El Portachuelo between Maracay and Ocumare, Aragua, flowers yellow, May 8, 1925, *Pittier 11820* (in Pittier's Herbarium, United States National Herbarium, record in Ames Herbarium); epifita, selvas pluviales de Rancho Grande (Parque Nacional), Aragua, 1300 metros, 11 Abril 1937, *Pittier 13966* (Pittier's Herbarium, record in Ames Herbarium).

Epidendrum Deamii *Schlechter* in Beihefte Bot. Centralbl. 36, Abt. 2 (1918) 402.

Epidendrum tessellatum Bateman ex Lindley in Bot. Reg. 24 (1838) Misc. p. 7, non Roxb. (1795).

VENEZUELA: in crotch of *Protium heptaphyllum*, Rancho Grande, Aragua, at 800 meters altitude, May 26, 1938, *Williams 10131.*

The above collection, which was sent by Professor H. Pittier, seems to be the first record of the species in South America.

Epidendrum oncidioides *Lindley* var. **gravidum** *(Lindl.) Ames, Hubbard & Schweinfurth* in Bot. Mus. Leafl. Harv. Univ. 3 (1935) 104.

Epidendrum gravidum Lindley in Journ. Hort. Soc. 4 (1849) 114—Ames in Sched. Orch. 4 (1923) 42, t. 2.
Encyclia gravida Schlechter in Beihefte Bot. Centralbl. 26, Abt. 2 (1918) 472.
Epidendrum argentinense Spegazzini in Anales Mus. Hist. Nat. Buenos Aires 28 (1916) 135, fig. 2—Hauman in Anales Soc. Cien. Argentina 90 (1921) 147.
Encyclia saltensis Hoehne in Arq. Bot. Estado S. Paulo n.s. 1 (1938) 19, t. 10.

The publication of *Encyclia saltensis*, by Dr. Hoehne, for a plant which I had been determining for my correspondents in Argentina as *Epidendrum argentinense* lead

to a study of the species which shows it to be one of the varieties of the widespread *Epidendrum oncidioides* Lindley.

Dr. Hoehne has apparently overlooked Spegazzini's publication of *Epidendrum argentinense* for otherwise it is difficult to understand how he could propose the plant as new under one of the generic segregates of Epidendrum.

Pseuderia ramosa *L. O. Williams sp. nov.*

Herba epiphytica, scandens. Caule ramoso. Folia lanceolata, acuminata, multinervia, basi vaginis caulem obtegentes. Inflorescentia brevis, plusminusve quinqueflora; bracteae lanceolatae vel ovatae, obtusae vel acutae. Sepalum dorsale anguste ellipticum, acutum vel obtusum, tri- vel quinquenervium. Sepala lateralia elliptica, acuta vel obtusa, arcuata, tri- vel quinquenervia. Petala anguste elliptica, obtusa, arcuata, tri- vel quinquenervia. Labellum obovatum, acutum, integrum, apice breviter pubescenti.

A scandent epiphytic herb of unknown size, the specimen at hand 3 dm. long. Stem coarse, branching, the main stem up to 8 mm. in diameter; the lateral branches smaller, mostly about 3 dm. long, the nodes 1–2 cm. apart. Leaves lanceolate, acuminate, thin when dry, 7–15 cm. long, 1.5–3 cm. broad, many-nerved; leaf-sheaths covering the stems. Inflorescence short, lateral, 3.5 cm. or less long, commonly rupturing the leaf-sheaths at about the middle, usually about 5-flowered; bracts lanceolate to ovate, obtuse or acute, 4–10 mm. long, 2–4 mm. broad. Dorsal sepal narrowly elliptic, acute or obtuse, about 12 mm. long and 3 mm. broad, 3- to 5-nerved. Lateral sepals elliptic, acute or obtuse, strongly arcuate, 10–12 mm. long, about 3 mm. broad, the apex somewhat callose-thickened, 3- to 5-nerved. Petals narrowly ellip-

tic, obtuse, arcuate, 3- to 5-nerved, about 10 mm. long and 2 mm. broad. Lip obovate, acute, simple, about 8 mm. long and 5 mm. broad, with one strong central, canaliculate, carinate callus extending from the base to beyond the middle, apex densely short-pubescent. Column of the genus.

Pseuderia ramosa seems to be most closely allied to *P. vanikorensis* Ames, a species which occurs in the Santa Cruz Islands. The following characters will serve to distinguish them.

Pseuderia ramosa	*Pseuderia vanikorensis*
Lip obovate, about 8 mm. long.	Lip elliptic, about 5 mm. long.
Petals 3- to 5-nerved, about 10 mm. long.	Petals 1-nerved, about 7.5 mm long.

Pseuderia ramosa is the first species of the genus to be reported from the Samoan Islands. It extends the range from the Fiji Islands, where two species of the genus are known, to Samoa which now constitutes the known eastern limit of the genus.

SAMOA: epiphytic on tree trunks, wet scrub-forest, top of Pioa, Island of Tutuila, flowers cream-white, at about 500 meters altitude, January 2, 1932, *Christophersen 3533* (TYPE in Herb. Bishop Museum, Honolulu; ISOTYPE in Herb. Ames No. 50309).

Dendrobium nanarauticolum *Fukuyama* in Tokyo Botanical Magazine 51 (1937) 900, fig.

CAROLINE ISLANDS, Ponape Island: Kaporujo, grows on tree trunks on the top of the mountain, rare, March 13, 1936, *Takamatsu 689* (in Herb. Bishop Museum and Herb. Ames).

This is a second collection of Professor Fukuyama's recently described species. *Dendrobium nanarauticolum* belongs to the group of the subgenus Bolbodium which is characterized by diphyllous pseudobulbs. Professor Fukuyama did not indicate to which species he con-

sidered the plant to be allied to nor have I been able to find one which is closely allied to it.

Glomera (Euglomera) **carolinensis** *L. O. Williams sp. nov.*

Herba epiphytica, tenella. Radices filiformes, elongatae, glabrae. Caules leviter complanati, basi foliorum vaginis verrucosis obtecti. Folia linearia vel lineari-lanceolata, acuta, apice bilobata, paulo obliqua. Inflorescentia subcapitata; bracteae lanceolatae. Sepalum dorsale lineari-oblongum, obtusum vel acutum, plusminusve quinquenervium. Sepala lateralia connata, oblonga, basi mentum saccatum formantia. Petala oblanceolata, obtusa, paulo obliqua, trinervia. Labellum saccatum, mento saccato circumdato; lamina late ovata, obtusa, paulo carinata.

A slender epiphytic herb up to 2 dm. tall. Roots filiform, elongated, glabrous. Stems somewhat flattened, covered by the persistent verrucose leaf-sheaths. Leaves erect, linear to linear-lanceolate, acute, apex unequally bilobed, slightly oblique, 3.5–7.5 cm. long, 4–8 mm. broad; persistent leaf-sheaths verrucose, especially above, about 1.3–2 cm. long. Inflorescence subcapitate, about 6-flowered, subtended and partly enclosed by a large, scarious, triangular bract; each flower subtended by a smaller lanceolate bract; flowers small for the genus. Dorsal sepal linear-oblong, obtuse or acutish, about 5-nerved, 6 mm. long and 1.5 mm. broad. Lateral sepals connate except about 1 mm. at the tips, forming a strongly saccate mentum at the base, the joined sepals oblong, about 5 mm. long and 3 mm. broad. Petals oblanceolate, obtuse, slightly oblique, 3-nerved, about 6 mm. long and 1.7 mm. broad toward the tip. Lip saccate, the sac contained within the saccate mentum; blade of the lip broadly ovate, obtuse, somewhat carinate, 1.5

mm. long, 1.2 mm. broad; sac oblong, 2 mm. long and 1.3 mm. broad. Column of the genus, about 1.5 mm. long.

Glomera carolinensis seems to be most closely allied to *G. bambusifolia* Schlechter, a New Guinean species. From this species, however, *G. carolinensis* may be distinguished by the comparatively narrow perianth parts and the different formation of the sac and the blade of the lip. *Glomera bambusifolia* is a much larger plant, up to 6.5 dm. tall, while *G. carolinensis* does not exceed 2 dm. in height.

Glomera carolinensis is the only species of the genus which has been reported from Micronesia. The nearest generic allies, in point of distance, would seem to be in New Guinea which is somewhat more than a thousand miles away.

CAROLINE ISLANDS, Ponape Island: Tolomail, grows on trees in open forest, February 11, 1936, *Takamatsu 988* (TYPE in Herb. Bishop Museum, Honolulu; ISOTYPE in Herb. Ames No. 50281).

Bulbophyllum Christophersenii *L. O. Williams sp. nov.*

Herba epiphytica, repens. Pseudobulbi conferti, pyriformis, unifoliati. Folia oblanceolata, cuneata, obtusa, coriacea, petiolata. Inflorescentia uniflora, quam folia paulo brevior. Sepalum dorsale lanceolatum, acutum, basi trinervium. Sepala lateralia lanceolata, acuta vel obtusa, basi trinervia. Petala linearia, acuta, uninervia. Labellum cordato-lanceolatum, obtusum, basi auriculatum, carinatum.

Epiphytic herbs from a repent rhizome. Pseudobulbs crowded on the rhizome, pyriform, 1–1.5 cm. long, up to 8 mm. in diameter, monophyllous. Leaves oblanceolate, cuneate, obtuse, coriaceous, petiolate, 6–18 cm. long, 1–2 cm. broad. Inflorescence 1–flowered, somewhat

shorter than the leaves, pedicel comparatively short, about 1–2 cm. long, the 6–8 cm. long pedicellate ovary appearing to be the pedicel. Dorsal sepal lanceolate, acute, about 12 mm. long and 4 mm. broad, 3-nerved at the base, several-nerved above. Lateral sepals lanceolate, acute or obtuse, 3-nerved at the base, several-nerved above, about 14 mm. long and 4 mm. broad. Petals linear, acute, 1-nerved, 3.5–4 mm. long, 0.5 mm. broad. Lip cordate-lanceolate, obtuse, auriculate at the base, thick and fleshy, about 4 mm. long and 2 mm. broad at the base. Column about 4 mm. long, with two terminal arms about 1 mm. long.

Bulbophyllum Christophersenii has no near allies which are known to me, certainly there are no known species in Polynesia which are allied to it.

SAMOA: epiphyte in open woodlands, east of Olo, Island of Savaii, flowers purple, at 700–800 meters altitude, August 8, 1931, *Christopherson & Hume 2297* (TYPE in Herb. Bishop Museum, Honolulu; ISOTYPE in Herb. Ames No. 59298).

Bulbophyllum Nagelii *L. O. Williams sp. nov.*

Herba epiphytica, repens. Pseudobulbi anguste-obpyriformes, unifoliati. Folia anguste-oblonga vel lanceolata, obtusa, coriacea. Inflorescentia densiflora, spicata; bracteae latae lanceolatae, acutae. Sepala lanceolata, acuminata, carinata, extus bracteolis parvis ornata. Petala lineari-lanceolata, acuta, uninervia, paulo serrulata. Labellum arcuatum, bicarinatum. Columna cum duobus stelidiis.

Repent epiphytic herbs. Stems slender, about 2–4 mm. thick. Pseudobulbs narrowly obpyriform, about 1.5–3.5 cm. long, 0.8–1.5 cm. thick, monophyllous. Leaves narrowly oblong to lanceolate, obtuse, abruptly contracted at the base, coriaceous, 7–12 cm. long, 1.4–2.3 cm. broad. Inflorescence densely flowered, spicate,

mostly about 3 cm. long; bracts narrowly lanceolate, acute, about 8 mm. long; rachis slightly thickened, depressed at the base of each flower. Flowers small, about equalling the subtending bracts in length. Sepals lanceolate, acuminate, carinate, 3-nerved, 6–7 mm. long, about 3 mm. broad at the base. Petals linear-lanceolate, acute, 1-nerved, minutely serrulate, about 4 mm. long and 1 mm. broad. Lip strongly arcuate, about 3 mm. long and 2–2.5 mm. broad, very fleshy except the lateral margins of the disc; with two carinae which merge into a single carina toward the apex. Bracteole opposite the petals, inconspicuous, about 0.5 mm. long. Column about 2 mm. long, with two lanceolate apical stelidia; column-foot prominent, about 2 mm. long.

Bulbophyllum Nagelii is not closely allied to any Mexican or Central American species of the genus but is perhaps closest to *B. pachyrachis* (A. Rich.) Grisebach, which it resembles somewhat in habit and in the structure of the flower. *Bulbophyllum Nagelii* may be distinguished from *B. pachyrachis* by its linear-lanceolate petals and from all known Mexican Bulbophyllums by the monophyllous pseudobulbs.

It is indeed a pleasure to name this plant for Mr. Otto Nagel. Mr. Nagel, who has collected in many remote regions of Mexico as well as the more accessible areas, has doubtless collected more specimens of the Mexican Orchidaceae than any other man. Regardless of the difficulties under which he has often worked, his specimens have always been superlatively good.

MEXICO: on oak trees in oak-pine forest, foot of Volcano Popocatépetl, north of Tetla del Volcán toward Santiago, longitude 98° 45′ west, latitude 18°54′ north, at about 1800 meters altitude, July 12, 1932 and May 15, 1933, *Nagel & Juan G.* [*onzáles*] *1022 and 2228*; pine and oak forest, southwest slope of the Volcano Popocatépetl, Tetla del Volcán, Morelos, longitude 98°45′ west, latitude 18° 54′ north, at 1800 meters altitude, flowers dull green infused with

purplish-red, May 21, 1938, *Williams & Nagel 3864* (TYPE in Herb. Ames No. 50433).

Govenia liliacea *(La Llave & Lex.) Lindl.* var. **Purpusii** *(Schltr.) L. O. Williams comb. nov.*

Govenia Purpusii Schlechter in Beihefte Bot. Centralbl. 25, Abt. 2 (1918) 412; Beihefte Fedde Repert. 59 (1921) t. 61, fig. 241.

Govenia liliacea var. *Purpusii* resembles a small and immature *Govenia liliacea*, but all of the plants of the variety which I have seen seem to bear but a single leaf with the possible exception of one plant on the Conzatti and González specimens which may have two leaves as in the species. The structure of the flower is the same in the variety as in the species except that in the variety the apex of the lip tends to be plicate.

MEXICO: Cerro de San Felipe, Oaxaca, at 3000 meters altitude, May 22, 1898, *Conzatti & González 703*; Matrata, Vera Cruz, May 7, 1937, *Matuda 1285*; cool rocky places, Sierra de Tequila, Jalisco, July 5, 1893, *Pringle 4419*; Cerro Verde, Oaxaca, July 1908, *Purpus 3613*.[1]

Vandopsis undulata *(Lindl.) J.J.Smith* in Nat. Tijds. Ned.-Ind. 72 (1912) 7.

Vanda undulata Lindley in Journ. Linn. Soc. Bot. 3 (1859) 42.

Stauropsis undulata Bentham & Hooker filius in Fl. Brit. Ind. 6 (1890) 27—Hooker filius in Ann. Roy. Bot. Gard., Calcutta 5 (1895) 36, t. 55—King & Pantling in Ann. Roy. Bot. Gard., Calcutta 8 (1898) 205, t. 275.

[1] The original number cited by Schlechter in his description is 2613 but that is probably a typographical error as there is a drawing of the type in the Ames Herbarium, prepared by Schlechter, and it bears the number 3613.

Fieldia undulata Reichenbach filius Xenia Orch. 2 (1862) 38.

Stauropsis polyantha W. W. Smith in Notes Roy. Bot. Gard., Edinburgh 13 (1921) 220.

Recently I have had the opportunity to examine authentic Chinese specimens of *Stauropsis polyantha* W. W. Smith and am unable to distinguish it from *Vandopsis undulata*. W. W. Smith records that the flowers of the Chinese and Burmese plants are almost twice as large as those of the Indian plant. While the flowers of the Chinese plants, which I have seen, are slightly larger than those of the Indian plants the difference is not great and hardily of noteworthy character.

Taeniophyllum (Subg. Geissanthera) **Hosokawae** *(Fukuyama) L. O. Williams comb. nov.*

Microtatorchis Hosokawae Fukuyama in Tokyo Botanical Magazine 51 (1937) 903, fig. 4–5.

The figures of this plant given by Fukuyama leave little doubt that the plant belongs to the subgenus *Geissanthera* (Schltr.) L. O. Williams of the genus *Taeniophyllum*. This would seem to be the fourth species belonging to this subgenus, the others are: *Taeniophyllum bracteatum* L. O. Williams, *T. papuanum* (Schltr.) L. O. Williams and *T. tubulosum* (J. J. Sm.) L. O. Williams.

Taeniophyllum Hosokawae is of further interest in that it is a considerable extension of the range of the subgenus.

Micronesia: Island of Ponape, *Hosokawa 5956*.

Taeniophyllum Parhamiae *L. O. Williams sp. nov.*

Herba parva epiphytica, acaulescens. Radices planae, uninerviae. Pedunculi breves, glabri vel verrucosi. Inflorescentia brevis, distichiflora. Sepalum dorsale lanceolatum, obtusum vel acutum, trinervium. Sepala lateralia

lanceolata, acuta, trinervia. Petala linearia vel linearioblonga, apice obtusa vel truncata, vix dentata, uninervia. Labellum saccatum; lamina anguste triangulari-subcordata, acuta, basi saccata, paulo scrotiformi.

Small acaulescent epiphytic herbs. Roots flattened, strongly 1-nerved, up to 25 cm. long or more. Peduncles short, glabrous but verrucose, at least when dry, up to 1 cm. long. Inflorescence probably 2–3-flowered, distichous; bracts acute, nearly 1 mm. long, semi-peltate, usually somewhat gibbous at the base. Perianth parts ocellate with crystalline inclusions, free to the base. Dorsal sepal about 3 mm. long and 1.2 mm. broad, lanceolate, obtuse or acute. Lateral sepals about 2.7 mm. long and 1.2 mm. broad, lanceolate, acute, 3-nerved, alate dorsally along the median nerve. Petals linear to linear-oblong, 1-nerved, apex obtuse or truncate, often dentate. Lip saccate; blade narrowly triangular-subcordate, acute, apical margins and the tip somewhat inrolled, about 2.5 mm. long and 1.5 mm. broad near the base; saccate base or spur of the lip slightly scrotoform, forming a 90° angle with the blade, about 2 mm. long and 1 mm. broad near the middle.

Taeniophyllum Parhamiae seems to be most closely allied to *T. decipiens* Schlechter, which occurs in the Samoan Islands, rather than to any species known to occur in Fiji.

It is with pleasure that this plant is named for Mrs. H. B. Richenda Parham and her two daughters, Miss Helena F. L. Parham and Miss Beatrice F. H. C. Parham, who have shown a keen interest in the native orchids of the Fiji Islands.

FIJI: epiphyte on Croton, Pender Street, Suva, June 26, 1938, *Parham 1*; in the old garden on breadfruit, Croton and coffee trees, Suva, August 24, 1938, *Parham 3* (TYPE in Herb. Ames No. 50094).

NOTES ON A REMARKABLE COLLECTION OF ORCHIDS FROM PANAMA

BY

CHARLES SCHWEINFURTH

MORE THAN HALF of a recent collection of orchids from the Province of Chiriquí, Panama, represents species which are unrecorded from Panama. However, as indicated in a letter received from C. H. Lankester, "a large series of plants is common to Chiriquí (from high elevations especially) and Costa Rica, without being truly members of the Panama flora . . . .".

All of these specimens were collected in Panama, Province of Chiriquí, Boquete District between January 5 and June 26, 1938 by Mrs. M. E. Davidson and are now incorporated in the herbarium of the Field Museum.

The Davidson collections are often amplified by notes of color or show characters which appear to be additional to, or at variance with those shown by other collections in the Ames Herbarium.

Elleanthus Tonduzii *Schlechter* in Fedde Repert. 8 (1910) 567.

Bajo Chorro, in rain forest, at 6000-7000 feet altitude, flowers white, *Davidson 123*; flowers yellowish green, *Davidson 161*, *247*, *365*.

These specimens have no good flowers, but the vegetative characters are apparently diagnostic.

Gomphichis costaricensis *(Schltr.) Ames, Hubbard & Schweinfurth* in Bot. Mus. Leafl. Harv. Univ. 3 (1934) 37.

Stenoptera costaricensis Schlechter in Beihefte Bot. Centralbl. 36, Abt. 2 (1918) 375.

Bajo Chorro, in rain forest at 6000-7000 feet altitude, *Davidson 163*; "Height 6-10 in.", leaves up to 10 cm. long, *Davidson 309*.

Stelis Skutchii *Ames* in Bot. Mus. Leafl. Harv. Univ. 6 (1938) 17, t. on p. 19.

Bajo Chorro, in rain forest, at 6000-7000 feet altitude, flowers very old, *Davidson 270*.

Stelis vestita *Ames* in Sched. Orch. 6 (1923) 56.

Boquete, dry hillsides, at 4000 feet altitude, epiphyte 4 to 8 inches tall, "Petals white with maroon centers", May 21, 1938, *Davidson 696*.

Restrepia subserrata *Schlechter* in Fedde Repert. Beihefte 19 (1923) 291.

Bajo Chorro, in rain forest, at 6000-7000 feet altitude, plant 3 to 6 inches high, flower yellow striped with maroon, *Davidson 116*.

Pleurothallis Cogniauxiana *Schlechter* in Fedde Repert. 3 (1907) 246.

Bajo Chorro, in rain forest, at 6000-7000 feet altitude, leaves oblong-lanceolate to elliptic-lanceolate, 11-11.4 cm. long, 1.7-2.5 cm. wide, *Davidson 109, 382*.

Pleurothallis pruinosa *Lindley* in Bot. Reg. 28 (1842) Misc. p. 75.

This species, recorded in Central America from Honduras and Costa Rica and in the West Indies from Jamaica to Trinidad, and also in French Guiana, is now reported from Panama.

Boquete, dry hillsides, at 3800 feet altitude, "epiphyte 1 to 3 inches high", flower pale yellowish green, May 24, 1938, *Davidson 708*.

Pleurothallis ruscifolia *(Jacq.) R. Brown* in Aiton Hort. Kew. ed. 2, 5 (1813) 211.

Epidendrum ruscifolium Jacquin Enum. Pl. Carib. (1760) 29.

Dendrobium ruscifolium Swartz in Nov. Act. Soc. Sci. Upsal. 6 (1799) 84.
Pleurothallis glomerata Ames in Sched. Orch. 4 (1923) 21.

This species, which appears to be frequent in Central America from Guatemala to Costa Rica, in the West Indies from Cuba to Trinidad and in South America as far as Peru and Bolivia, is here recorded from Panama.

Bajo Chorro, in rain forest, at 6000-7000 feet altitude, *Davidson 262*; epiphyte 8-13.6 inches tall, flower yellow, March 19, 1938, *Davidson 419*.

Pleurothallis uncinata *Fawcett* in Journ. Bot. 33 (1895) 12.

Pleurothallis Alexandrae Schlechter in Fedde Repert. Beihefte 19 (1923) 103.

Bajo Chorro, in rain forest, at 6000-7000 feet altitude, flower greenish yellow, *Davidson 220*.

Lepanthes elata *Reichenbach filius* in Beitr. Orch. Centr.-Am. (1866) 90.

Bajo Chorro, in rain forest, at 6000-7000 feet altitude, flowers yellow with maroon lip, *Davidson 237*.

While no good flowers are available on this specimen the vegetative aspect is characteristic.

Lepanthes eximia *Ames* in Sched. Orch. 5 (June 1923) 21.

Lepanthes abnormis Schlechter in Fedde Repert. Beihefte 19 (November 1923) 21.

Bajo Chorro, in rain forest, at 6000-7000 feet altitude, flower "tinted pink", *Davidson 186*.

Lepanthes insectiflora *C. Schweinfurth sp. nov.*

Herba epiphytica, pusilla. Caules caespitosi, filiformes, patentes, apice monophylli, vaginis arctis tubularibus cum ostiis ovatis ciliatis ornati. Folium ovatum vel elliptico-ovatum, erectum, apice acuminato tridentatum, basi cuneatum. Inflorescentiae singulae vel paucae, folii medium superantes. Racemi pauciflori. Bracteae extus muriculatae. Sepala triangulari-linearia, dorso alti-carinata. Sepalum dorsale trinervium. Sepala lateralia uninervia. Petala transverse bilobata lobis valdissime inaequalibris; lobus posterior elongatus, angustissime triangulari-linearis; lobus anterior perparvus, ovatus. Labellum acriter bilobatum, lobis semiovatis. Columna gracilis labelli lobos superans.

Plant caespitose, spreading, very slender. Roots fibrous, flexuous, apparently pubescent. Stems filiform, about 2.6–7.5 cm. long, almost entirely invested by about six to sixteen close tubular minutely muriculate sheaths which terminate abruptly in spreading ovate mucronate ciliate mouths. Leaf solitary, erect, ovate to elliptic-ovate, up to 2.4 cm. long and 8 mm. wide, somewhat acuminate above with a tridenticulate apex of which the central tooth is slender and projecting, cuneate below to a subpetiolate base. Inflorescences one to five, shorter than the leaf, about 2- to 12-flowered; bracts infundibuliform, muriculate on the outer surface, about half as long as the slender pedicels. Flower membranaceous, segments spreading. Sepals triangular-linear, long-acuminate with a complicate apex. Dorsal sepal about 5 mm. long and 1 mm. wide at the base, 3-nerved through the basal third with the nerves carinate on the outer surface (the median keel is relatively high, thin and cellular-denticulate). Lateral sepals similar but narrower, 1-nerved and dorsally carinate with the keel cellular-denticulate, about 5 mm. long and 0.8 mm. wide at the

base. Petals transversely bipartite with the lobes horizontal, continuous and very unequal; posterior lobe elongate, very narrowly triangular-linear, about 3.2 mm. long; anterior lobe very short, ovate, about 0.7 mm. long. Lip sharply bilobed (with the lobes semiovate, about 1 mm. long and fleshy-thickened on the lateral margins), protuberant in the sinus into a minute porrect apicule. Column slender, surpassing the lip, about 1.6 mm. long, above with a relatively large hemispherical cavity below and posterior to the clinandrium.

This species differs from *Lepanthes tipulifera* Reichb. f. in having rather longer stems and very unequal lobes of the petals. It appeared in a mixture with another species of *Lepanthes*.

PANAMA: Province of Chiriquí, Boquete District, Bajo Chorro, at 6000 feet altitude, epiphyte in rain forest, 2 to 4 inches high, flowers burnt orange (?), January 22, 1938 *M. E. Davidson 185* (TYPE in Herb. Field Mus. No. 915594; DUPLICATE TYPE in Herb. Ames No. 49038).

Epidendrum confertum *Ames & Schweinfurth* in Sched. Orch. 10 (1930) 61.

Epidendrum prostratum Schlechter in Beihefte Bot. Centralbl. 36, Abt. 2 (1918) 407, non Cogn.

Bajo Chorro, in rain forests, at 6000-7000 feet altitude, flower reddish brown, *Davidson 246*.

Epidendrum paranthicum *Reichenbach filius* in Bot. Zeit. 10 (1852) 732.

Epidendrum Sancti Ramoni Kränzlin in Vierteljahrsschr. Naturforsch. Gesell. Zürich 74 (1929) 137.

Bajo Chorro, in rain forest, at 6000-7000 feet altitude, *Davidson 121*.

Epidendrum ramosum *Jacq.* var. **imbricatum** *(Lindl.) Ames, Hubbard & Schweinfurth* in Bot. Mus. Leafl. Harv. Univ. 2 (1934) 47.

Epidendrum imbricatum Lindley Gen. & Sp. Orch. Pl. (1831) 110, non Lam.
Epidendrum biflorum Cogniaux in Bull. Herb. Boiss. ser. 2, 2 (1902) 337, t. nec Forst.f., nec Ruiz & Pav., nec Rodr.
Epidendrum Boissierianum Schlechter in Beihefte Bot. Centralbl. 36, Abt. 2 (1918) 459.
Epidendrum santaclarense Ames in Sched. Orch. 4 (1923) 49.

Bajo Chorro, in rain forest, at 6000-7000 feet altitude, *Davidson 213*.

Epidendrum Sanchoi *Ames* in Sched. Orch. 4 (1923) 48.

Bajo Chorro, in rain forest, at 6000-7000 feet altitude, flowers pale yellow, *Davidson 114, 348*.

Epidendrum trachythece *Schlechter* in Fedde Repert. 3 (1907) 249.

Bajo Chorro, in rain forest, at 6000-7000 feet altitude, flowers white, *Davidson 124*.

Bletia Lankesteri *(A. & S.) Ames, Hubbard & Schweinfurth* in Bot. Mus. Leafl. Harv. Univ. 3 (1934) 41.

This species is now recorded from Panama.

Boquete, at 5000 feet altitude, herb on open hillside, 12 to 18 inches high (specimen in bud), "flower deep rose pink, central petals white at base", June 26, 1938, *Davidson 768*.

Bletia tuberosa *(L.) Ames* in Proc. Biol. Soc. Wash. 45 (1932) 1.

The present example of this widespread species is only about 3 inches tall, but the loose flower is approximately of the usual size.

Boquete, at 4000 feet altitude, terrestrial on open hillside, 3 inches high, flower white, June 24, 1938, *Davidson 741*.

Maxillaria meleagris *Lindley* in Bot. Reg. 30 (1844) Misc. p. 3.

Bajo Chorro, in rain forest, at 6000-7000 feet altitude, plant 8 to 15 inches high, the stem below the pseudobulb is lacking and doubtless has been broken off, flower "reddish brown, paler at base of petal", *Davidson 115*.

Maxillaria parvilabia *Ames & Schweinfurth* in Sched. Orch. 8 (1925) 62.

Bajo Chorro, in rain forest, at 6000-7000 feet altitude, flower pale yellow, *Davidson 126*.

Maxillaria valenzuelana *(A. Rich.) Nash* in Bull. Torr. Bot. Club 34 (1907) 121.

This distinct species is recorded from Cuba, from Honduras to Costa Rica and also from Colombia and Brazil. It is here reported from Panama.

Boquete, at 3800 feet altitude, epiphyte 6 to 10 inches high, flower "yellow, lip dotted maroon", May 12, 1938, *Davidson 636*.

Camaridium Biolleyi *Schlechter* in Beihefte Bot. Centralbl. 36, Abt. 2 (1918) 498.

Ornithidium Biolleyi Schlechter in Fedde Repert. 9 (1910) 29.

Bajo Chorro, in rain forest, at 6000-7000 feet altitude, flowers white with crimson lip, *Davidson 125*.

Camaridium Bradeorum *Schlechter* in Fedde Repert. Beihefte 19 (1923) 141.

Bajo Chorro, in rain forest, at 6000-7000 feet altitude, plant 2-3 feet high, flower white, each petal blotched with rose, *Davidson 118*.

Camaridium dendrobioides *Schlechter* in Beihefte Bot. Centralbl. 36, Abt. 2 (1918) 415.

Camaridium Jimenezii Schlechter in Beihefte Bot. Centralbl. 36, Abt. 2 (1918) 416.

Camaridium simile Schlechter in Fedde Repert. Beihefte 19 (1923) 239.

Bajo Chorro, in rain forest, at 6000-7000 feet altitude, *Davidson 240*.

Camaridium nutantiflorum *Schlechter* in Beihefte Bot. Centralbl. 36, Abt. 2 (1918) 417.

Bajo Chorro, in rain forest, at 6000-7000 feet altitude, *Davidson 308*.

Ornithidium costaricense *Schlechter* in Fedde Repert. 8 (1910) 456.

Bajo Chorro, in rain forest, at 6000-7000 feet altitude, *Davidson 325*; plant 3-4 feet tall, leaves uncommonly large (one is about 30 cm. long, another one is about 2.2 cm. wide), *Davidson 326*.

Ornithidium Pittieri *Ames* in Sched. Orch. 2 (1923) 35.

Bajo Chorro, in rain forest, at 6000-7000 feet altitude, plant 2-4 feet high, flowers pink, *Davidson 310*.

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BOTANICAL MUSEUM LEAFLETS
HARVARD UNIVERSITY

CAMBRIDGE, MASSACHUSETTS, SEPTEMBER 6, 1939 VOL. 7, NO. 10

THE FOSSIL FLORA OF IOWA COAL BALLS

II. THE FRUCTIFICATION OF BOTRYOPTERIS

BY
WILLIAM C. DARRAH

BOTRYOPTERIS is a genus of primitive ferns belonging to the extinct class or order known as the *Coenopteridales* (5,6). Nearly a dozen species have been described but all except the genotype (15) are very imperfectly known. The described species are restricted to the Carboniferous rocks of France (4), England, Scotland (18), Germany (8), Belgium (13), Holland (12) and Illinois (9,11).

Among the most abundant plants present in the coal balls from Dallas County, Iowa, are many petioles referable to three species of *Botryopteris*, one of which bears a large globose mass of sporangia. Seven specimens of this fructification have been collected in the Shuler Mine, and an additional specimen in the Urbandale Mine (7).

Botryopteris forensis Renault (15), the type of the genus, is the only species known from the fructification, the petiole, and presumably the leaf. All other members of the genus are known only from petrified petioles. The shape of the xylem of the stele, as viewed in transverse section, is the chief generic character (2,4). The petioles, which are circular in section, have a broad cortex, and the xylem has a w or ω shape. The three points of the stele point towards the axis. The leaves are believed to

have been highly compound and to have had fleshy lobed pinnules, probably of the *Sphenopteris* type.

The original specimen described by Renault, which he described as "le fragment, qui contenait seulement une portion de ces fructifications", had the following dimensions:

length (height)	4 to 5 cm.
diameter (width)	3 to 4 cm.
diameter (thickness)	2 to 3 cm.

This last measurement was taken at right angles to the width ("largeur").

The pyriform sporangia had a maximum diameter of 0.7 to 1.0 mm., and a length of 1.5 to 2.0 mm. The sporangia were attached in groups of five or six, sometimes more, and their total aggregation must have amounted to thousands.

The Iowa material is, on the whole, very similar to *Botryopteris forensis* but in many details differs so that it is here regarded to be specifically distinct.

Material at hand

Specimens in the Collections of the Botanical Museum of Harvard University:

Shuler Mine, Dallas County, Iowa:

42159 Cotype, nearly complete
42635 Cotype, nearly complete
42160 large mass, showing extensive surface
42161 branched axis, impression view, not sawn
42162 large mass of sporangia
42163 large mass of sporangia
42618 small portion of a fructification

Urbandale Mine, Dallas County, Iowa:

42679 fairly large mass of sporangia

Dimensions of the fructifications

	Specimen 42159	*Specimen 42635*
maximum diameter	58 mm.	56 mm.
minimum diameter	49 mm.	27 mm.
height	47 mm.	not determined
xylem of petiole, breadth	2.2 mm.	1.8 mm.
"length" of petiole	8 mm.	6.5 mm.
"width" of petiole	4.5 mm.	4.2 mm.

The sporangia vary in length from 1.5 to 1.7 mm., and in diameter from 1 to 1.2 mm. Many smaller "diameters" have been measured and recorded, but they are invariably from planes which are not median.

The spores measure 0.05 to 0.065 in diameter and are nearly spherical in shape. The tetrad scar is prominent though not large. Some spores, especially those viewed from the apex or scar end, appear to be slightly triangular in outline, but this may be due either to preservation or immaturity.

The sporangium is constructed of two layers of cells, an outer layer composed of more or less cubical, thick-walled cells, enlarged over one side to form an annulus, and an inner layer of thin-walled cells, smaller in size than those of the outer layer. This inner layer is only occasionally preserved, and since its ontogeny is unknown, it is not possible to term it tapetal. The sporangia are grouped in numbers varying from three to ten (sometimes even more) attached to short pedicels, which are the termini of a much-branched axis. The pedicels are provided with a vascular strand composed of several cells of scalariform tracheids. The "petioles" which bear the pedicels have the characteristic Botryopterid ω-shaped stele.

Comparison with Botryopteris forensis

It is obvious that the spores of the Iowa species are

smaller than those found in *Botryopteris forensis* from St. Etienne, France. I have before me, two ground sections of detached sporangia collected in 1935 from Comberigolle (Grand 'Croix) near St. Etienne, prepared by one of my students, Mr. William S. Benninghoff. The spores in these sporangia have a maximum diameter of 0.07 mm. and agree in size with the recordings of Renault. The sporangia in the Iowa specimens are much less elongate, more nearly spherical. In other details such as the annulus, sporangial wall, attachment and spore number, the two forms are very similar.

Comparison with other Botryopterid sporangia

In 1902, Oliver (14) described a remarkable vascular sporangium from Grand'Croix which he was inclined to refer to *Botryopteris*, perhaps even *Botryopteris forensis*, assuming that the preservation of his specimen could have been better than that of Renault's types. However, the spores in this sporangium have a diameter of only 0.02 mm., instead of 0.06 to 0.07 mm. as in *Botryopteris forensis*. The unusual tracheidal nature of the cells of the outer wall, at once distinguishes this specimen from the Iowa form.

Renault (15) also described sporangia under the name of *Botryopteris dubius*, which are characterized by an elaborate sporangial wall, at least two layers in thickness, of which the outer is three or four cells deep. The spores have a diameter of 0.08 mm. The Iowa specimens have a much more simple wall and much smaller spores. Renault subsequently (17) referred this form to *Zygopteris*.

Description of the specimens

On the first plate, the figure at the top shows the broken surface of a mass of sporangia in a vertical plane beyond, i.e. outside of, the axis. In other words it pre-

sents a longitudinal view of a sporangial mass. The very numerous pyriform sporangia are grouped around the ultimate divisions of a much-branched axis. The arrangement of sporangia can be seen in the upper right quadrant of the illustration.

The lower figure on the first plate shows a cut surface, sawn within a few degrees of a right angle to the axis. Here again we can observe the prodigious number of sporangia and the enormous size of the fructification.

On the second plate there is illustrated a small portion of a section taken diagonally through the axis. It is nearly transverse and shows the petiole giving off a branch. The stele of the petiole has the characteristic trident-shape which is known to be a generic character. The sporangia here seem to have walls which are only one cell in thickness, but this is due to incomplete preservation. There is an annulus which is evident on several of the sporangia near the top right.

The figure on the third plate shows a longitudinal view through a mass of sporangia and through the petiole or axis. At the lower left, a group of five (six ?) sporangia are clustered around a pedicel. A similar cluster is shown at the top right.

The figure on plate four shows portions of seven sporangia—three of them nearly complete.

The number of spores in each sporangium is large—several hundred being a minimum estimate.

The sporangia on plate five show clearly the crowded condition of the sporangial mass and the relative size of the spores. Near the top left corner the sporangium adjacent to the limb of the petiole shows the annulus. A number of the sporangia show the rather decomposed, at least poorly preserved, inner cell layer. The sporangium at the bottom center, and several near the true center of the illustration, reveal this moderately well.

The illustration on plate six gives an excellent idea of the complicated branch system. The main petiole or "stem" which bears this fructification has branched several times, so that at the plane of this preparation, four "secondary" petioles carry the actual fruiting portion of the plant. These are branched many times, as is most evident.

Diagnosis of the species

Botryopteris *Renault* 1875 Ann. Sci. Nat. (Bot.) (6e Ser.) T.1, p.223.

Botryopteris globosa *Darrah sp. nov.* 6 plates.

Fern fructification, naked, pedicellate, composed of a great globose aggregation of sporangia measuring approximately 5 cm. $\times$5 cm. $\times$6 cm., borne terminally upon a petiole provided with the typical Botryopterid stele. Sporangia moderately large, approximately 1.5$\times$1.0 mm. in diameter, more or less angular in shape but slightly pyriform, borne in clusters of from three to ten, or more, upon short pedicels, which are the ultimate branches of the petioles. Spores moderately large, nearly spherical, varying in diameter from 0.05 to 0.065 mm.

Foliage unknown.

Iowa: Dallas County, Waukee, Shuler Coal Mine, and Urbandale Coal Mine. F.O.Thompson Collection 42159, 42635 Cotypes, also 42160, 42161, 42162, 42163, 42618 all Shuler Mine. 42679 Urbandale Mine.

Carboniferous: Pennsylvanian: Des Moines Series: Coal number 7.

Specimens in the Paleobotanical Collections of the Botanical Museum of Harvard University.

Scott (18) suggested that the large mass of crowded sporangia represented "no doubt, the collective output of a compound fertile frond". He interpreted the fructi-

fication as a branched rachis. Scott figured (loc.cit. figure 153) the oft-copied original of Renault which shows four sporangia attached to a short pedicel on a portion of a branch of the axis. This drawing gives a most inadequate conception of the plant.

Seward (19) reproduced another of Renault's original drawings which gives a somewhat better idea of the robust size of the fructification, but here again, the illustration represents a mere fragment of the whole.

Renault, in 1896, figured what he considered to be two leaflets of *Botryopteris*. These fleshy pinnules appear to have been provided with unusually thick cross veins, giving a very unlife-like aspect. It is curious to observe, however, that the branch system which bears the sporangial aggregation of *Botryopteris* is strikingly similar. Hirmer's (10) reproduction of Renault's figure is probably more generally available than the original. It is figure 653 on page 535. A rather crude drawing of the specimen can be consulted also in Seward (19), vol. 2, p. 445, fig. 309 B.

Renault has interpreted *Botryopteris forensis* as being heterosporous. He described spores with a triradiate scar as being megaspores and similar spores but with multicellular construction as microspores.

Zeiller (1900, p. 74, fig. 73) refigured two of Renault's drawings but questioned their heterospory.

Most investigators since Zeiller have doubted that Renault really observed endosporal development and regard the conclusion that *Botryopteris forensis* was heterosporous as unfounded.

Two workers, however, have made interesting use of the possibility (Thomson (21), Benson (1)). The evidence derived from *Botryopteris globosa*, of course, cannot be used to challenge any conclusion based entirely upon observations on *Botryopteris forensis*, but it is significant

that all of the spores studied in the Iowa species are of a single type and size, bearing a normal tetrad scar which certainly indicates a homosporous eusporangiate fern, and we have not observed the slightest evidence of endosporal development. The degree of preservation is not as good as desirable—no fossil ever is—but such contents as are preserved in some of the spores appear to have been non-cellular.

There are several important questions relating to the Coenopterids which at this time suggest themselves. As yet we are not in possession of facts sufficient for satisfactory answers.

Is this massive fructification a strobilus? The ferns are non-strobilar, but here is a much-branched axis constructed, not on a pinnatifid, but upon a radial plan. The pyriform sporangia are pedicellate. It is true that *Stauropteris*, a still more "primitive" Coenopterid fern is radially symmetrical and bush-like but the sporangia are believed to have been borne terminally in small lax clusters (3).

If the fructification is strobilar, or "pseudo-strobilar", what is its possible relationship to the pteridosperms? One of the fundamental gaps or "missing-links" in our knowledge of the earliest gymnosperms is their degree of kinship with the filicinean pteropsids.

In any case, this unique structure among the ferns, now partially understood, will reshape our conception of the *Coenopteridales*. That they were a very diversified group is well-known. How diversified is still a matter for speculation, but with certainty more than any of us have supposed.

BIBLIOGRAPHY

1. Benson, M., 1904: *Telangium Scotti*. Ann. Bot. Vol. 18, p.161.
2. Bertrand, P., 1911: L'étude anatomique des fougères anciennes. Progr. Rei Bot. pp. 182-302.
3. Bower, F.O., 1926: The Ferns. Vol. 2. Cambridge.
4. Corsin, P., 1937: Contribution à l'ètude des Fougères anciennes du Groupe des Inversicatenales. pp. 187-228, Lille.
5. Darrah, W.C., 1939: Principles of Paleobotany. p.82, Leiden.
6. Darrah, W.C., 1939: Textbook of Paleobotany. pp. 133-136, New York.
7. Darrah, W.C., 1939: The Fossil Flora of Iowa Coal Balls. I. Discovery and Occurrence. Bot. Mus. Leafl. Harvard Univ. Vol. 7, pp.125-136.
8. Felix, J., 1887: Untersuchungen über den inneren Bau Westphalischer Carbon Pflanzen. Abh. K. Geol. Landesanst. Bd. 7, p. 12.
9. Graham, R., 1935: Pennsylvanian Flora of Illinois as revealed in Coal Balls. Bot. Gaz. Vol. 97, pp. 162-163.
10. Hirmer, M., 1927: Handbuch der Paläobotanik. Bd. 1, pp.532-538, München.
11. Hoskins, J.H., 1930: Contribution to the Coal Measure Flora. Amer. Midl. Nat. Vol. 12, pp. 154-156.
12. Koopmans, R., 1928: Researches on the Flora of the Coal-balls from the Finefrau-Nebenbank Horizon in the Province of Limburg (The Netherlands). pp. 32-33, Heerlen.
13. Leclercq, S., 1925: Les Coal Balls de la Couche Bouxharmont des Charbonnage Werister. pp. 57-59, Liège.
14. Oliver, F.W., 1902: A Vascular Sporangium. New Phytol. Vol. 1, p. 60.
15. Renault, B., 1875: Étude du genre *Botryopteris*. Ann. Sci. Nat. Bot. (6), Vol. 1, pp. 220-240.
16. Renault, B., 1878: Recherches sur la Structure et les Affinités Botaniques des Végétaux Silicifiés. pp. 95-114, Autun (La Société Eduenne).

17. Renault, B., 1896: Flore fossile d'Autun et d'Epinac, pt. ii, pp. 47-59.

18. Scott, D.H., 1920: Studies in Fossil Botany. 3rd. ed. Vol. 1, p. 341.

19. Seward, A.C., 1910: Fossil Plants. Vol. 2, p. 437, Cambridge.

20. Solms-Laubach, H,G., 1891: Fossil Botany. Engl. ed. p. 150, Oxford.

21. Thomson, R.B., 1927: Evolution of the Seed Habit in Plants. Trans. Roy. Soc., Canada, Ser. 3, Vol. 21, pp. 229-272.

22. Zeiller, R., 1900: Éléments du Paléobotanique. Paris.

EXPLANATION OF THE ILLUSTRATIONS

PLATE I. BOTRYOPTERIS GLOBOSA *Darrah*. The figure at the top shows the broken surface of a mass of sporangia in longitudinal view. The plane is not median, but beyond the main axis. The branching which appears in this view is that of a secondary petiole. Near the left of the upper right quadrant of the sporangial mass is a cluster of sporangia grouped around a short pedicel. Natural size. Heliotype reproduction of a photograph of specimen number 42159 (COTYPE), Paleobotanical Collection of the Botanical Museum.

The figure at the bottom shows a transverse view of a fructification, sawn at a right angle to the main axis. The axis ("petiole") is located slightly below the center of the illustration. In this specimen it is surrounded by crystalline calcite which appears as a white region in the figure.

Specimen number 42159. Natural size.

PLATE II. BOTRYOPTERIS GLOBOSA *Darrah*. Heliotype reproduction of a photograph of a cellulose nitrate peel prepared from the surface of the specimen illustrated at the bottom of Plate I. The stele of the petiole shows the departure of a branch. The ω shape of the xylem of the stele is evident at the bottom of the illustration. Magnified twenty times natural size.

PLATE III. BOTRYOPTERIS GLOBOSA *Darrah*. Vertical (longitudinal) section through the main axis bearing the sporangial mass. The plane of the section is tangential to the axis, i.e. all of the tissue shown in the petiole is cortical. At the top left a secondary branch shows several pedicels, which are surrounded by sporangia. A similar cluster is shown at the bottom right. Twenty times natural size.

Reproduced from a photograph of a cellulose nitrate peel from specimen number 42159.

PLATE IV. BOTRYOPTERIS GLOBOSA *Darrah*. Several sporangia, filled with spores. Reproduced from a photograph of a cellulose peel taken from specimen number 42159. Fifty times natural size.

PLATE V. BOTRYOPTERIS GLOBOSA *Darrah*. Reproduction of a photograph of a cellulose nitrate peel showing a number of sporangia which have the sporangial walls fairly well preserved. The sporangium adjacent to the limb of the petiole near the upper left corner shows a few cells of the annulus. Several of the sporangia near the center show remnants of the inner cell layer. This layer is usually indicated as a shrunken tissue that has pulled away from the outer layer. This is best demonstrated by the sporangium at the bottom center and the contiguous sporangium above it. Reproduced from a photograph of a cellulose nitrate peel from specimen number 42635 (COTYPE) in the Paleobotanical Collection of the Botanical Museum. Twenty times natural size.

PLATE VI. BOTRYOPTERIS GLOBOSA *Darrah*. Reproduction of a photograph of a cellulose nitrate peel from a specimen cut transversely through the fructification, showing the enormous number of sporangia and their crowded arrangement. At this plane,four "secondary petioles" are visible. These have resulted from repeated branching of the main axis ("primary petiole") and carry the sporangial mass. The two petioles near the center indicate the nature of the subsequent branching. The small ultimate branches are scattered throughout the mass. Peel taken from specimen number 42635. Five times natural size.

Plate I

Plate II

Plate III

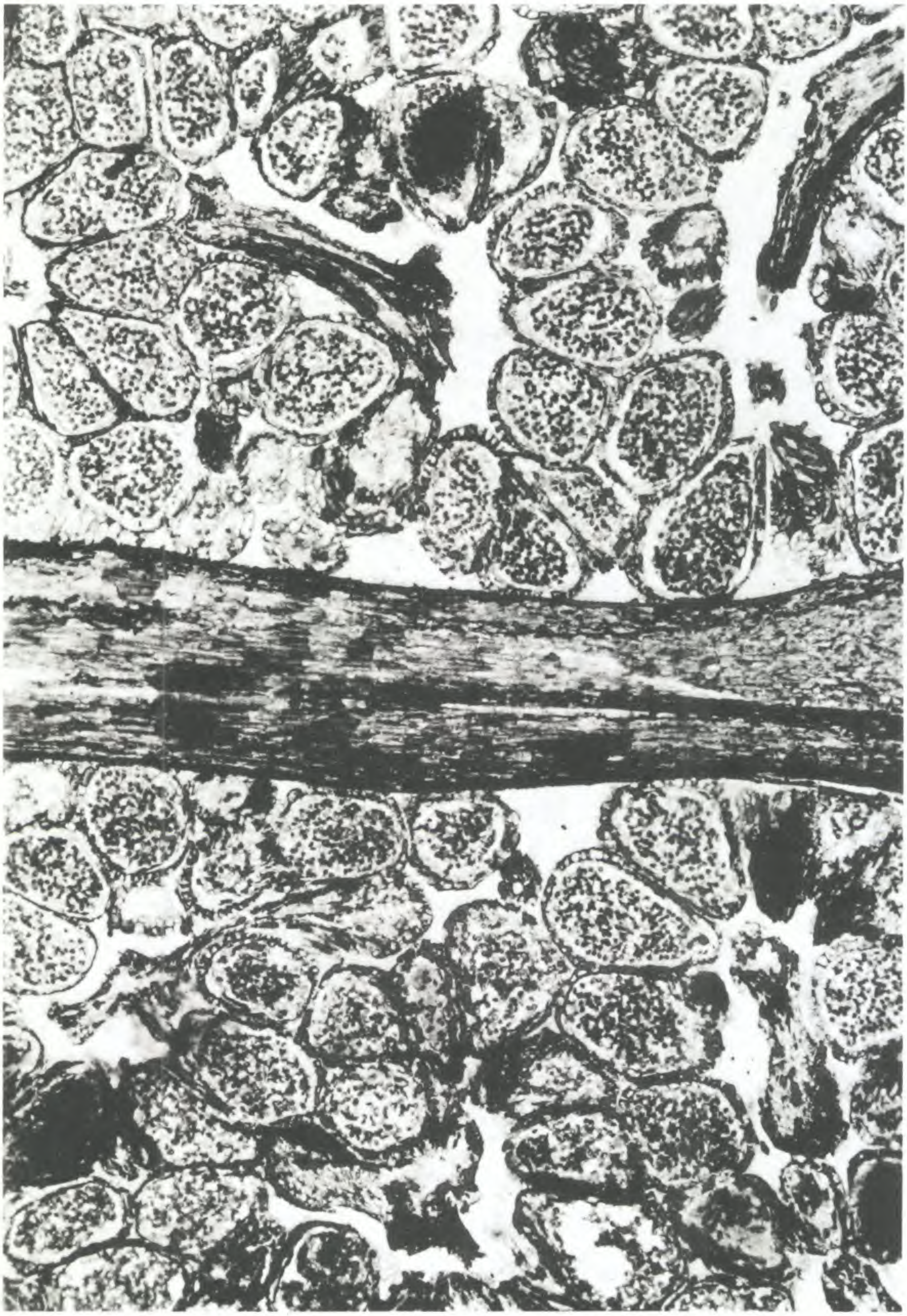

Plate IV

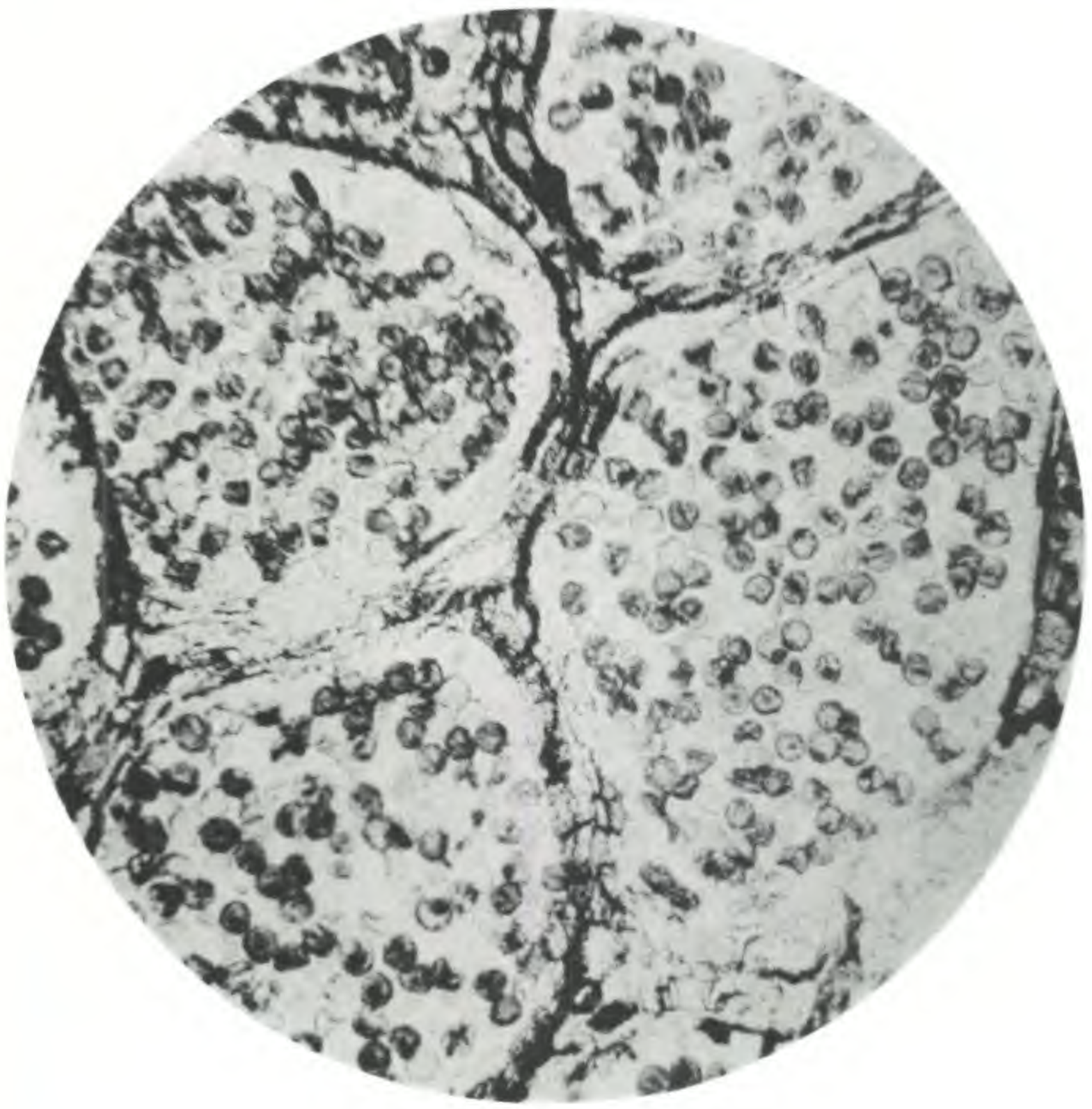

Plate V

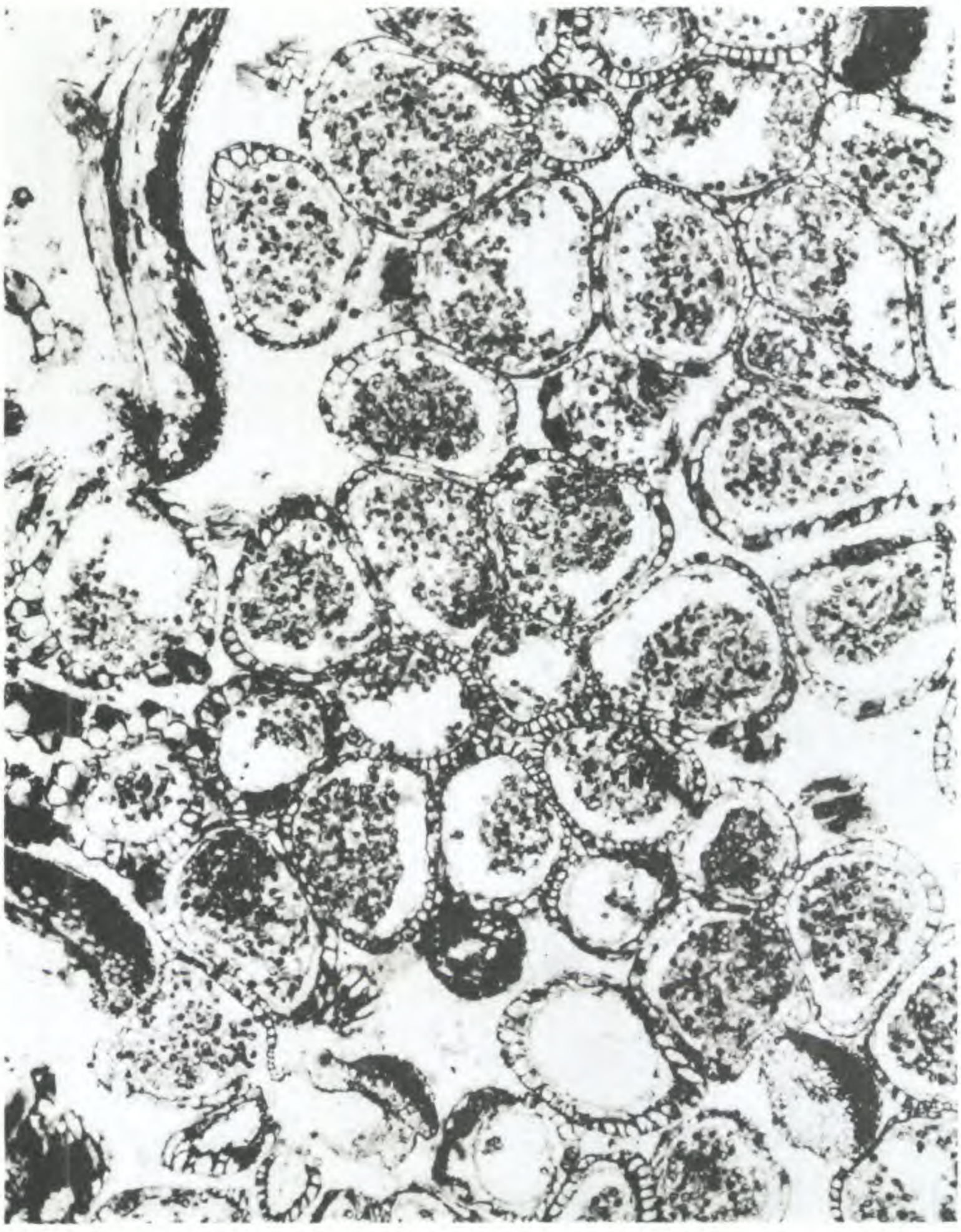

Plate VI

BOOK REVIEW

BY

LOUIS O. WILLIAMS

Catálogo Descriptivo de las Orquídeas Cubanas [Descriptive Catalogue of Cuban Orchids], by Julian Acuña Galé. Boletin Técnico No. 60, Estación Experimental Agrónomica, Cuba. 221 pages. Dated June 1938, issued about June 5, 1939.

Mr. Acuña's descriptive catalogue of Cuban orchids will be welcomed by his compatriots and by others who are interested in this delightful family of plants. The catalogue gives an artificial key to the seventy-nine genera of orchids which are accredited to Cuba. Each of the genera is characterized and a key to the component species is given, if there is more than one. Bibliography, synonymy and a specific description, as well as Cuban localities and often distribution outside of Cuba, are given for each species.

It is the hope of the author that his little book will help beginners so that more people will become interested in botany and so that there will be more botanists in Cuba. With this objective in mind, one might have expected a more conservative treatment of generic entities. One "feels" for the beginner (or the mature taxonomist for that matter) who attempts to key out a Cuban Spiranthes to one of the six segregate (or synonymous) genera which are given, by means of a key which makes use of rather recondite and none too accurately stated characters. Likewise one might possibly entertain doubts about the usefulness of the eight segregates of Epidendrum which will be encountered, to only one of which Ames, Hubbard and Schweinfurth accorded even subgeneric rank in their recent monograph on Epidendrum.

If the taxonomic outlook of the author may be said

to be provincial in the case of generic entities, as would seem to be indicated by the paragraph above, it is no less so in the case of the treatment of some of the species. One case will illustrate this point. On page 85 a new name, *Auliza Wilsoni* Acuña is given; a name based on *Epidendrum variegatum* Hooker, not Swartz. Distribution in Cuba is given but no external range is indicated. Now the species upon which Acuña's name is based was Brazilian in origin therefore the new name, historically, applies to a Brazilian plant. If one turns to Ames, Hubbard and Schweinfurth's work, which covers the species of continental North America, he will find at least four specific names, under *Epidendrum crassilabium* Poeppig & Endlicher, that have precedence over the name proposed by Acuña.

Mr. Acuña has proposed five new species in his catalogue, *Habenaria palustris*, *Corymborchis cubensis*, *Malaxis Brittonii*, *Spathiger Roigii*, and *Cattleyopsis guanensis*. These proposals lack any attempt at Latin diagnoses and hence may not be considered as validly published in accordance with present rules of botanical nomenclature.

It should be noted, in passing, that through some slip of the pen the title page is dated "Junio 1938". The actual date of publication is possibly about June 5, 1939.

The body of the text of the catalogue is in rather pleasing and convenient form. Perhaps a little more attention to proof reading would have eliminated many typographical errors and inconsistencies in citations and have made the catalogue more authoritative.

A NOTE CONCERNING THE ORCHIDS DESCRIBED BY KRÄNZLIN, MAINLY FROM THE LIEBMANN MEXICAN COLLECTION

BY

LOUIS O. WILLIAMS

Professor O. Hagerup of the Universitetets botaniske Museum in Copenhagen has been kind enough to send for study all of the types of the species described by Kränzlin in Saertyrk af Vidensk. Medd. fra Dansk naturh. Foren. 71 (1920) 169-180.

Most of the specimens are in liquid and often consist of the flowers only, hence it is not possible, in all cases, to be sure what the plants are but the determinations for most of them can be made with reasonable assurance.

The order followed is that of Kränzlin, giving first, in capitals, the name which he used. The following name (if it differs from that used by Kränzlin), in bold face, is the name which seems to be correct.

PLEUROTHALLIS MANDIBULARIS *Kränzlin*, p. 169. This is probably a synonym of **Pleurothallis vittata** *Lindley* of Mexico.

PLEUROTHALLIS LIEBMANNIANA *Kränzlin*, p. 170, seems to be a good species. The type consists of two sheets of material.

Although Kränzlin says that the specimens are "ohne genaueren Standort (Liebmann, ohne n. !)" the data on the sheets are "parasitica in arboribus vetustis sylvarum inter Lobani [?] et Petlapa, 6 / 1842". There are two numbers available. The original (field?) number is 339–340 and the Plantae Mexicanae Liebmann. number is 7309.

Restrepia Liebmanniana *Kränzlin*, p. 171 = **Pleurothallis hastata** *Ames*, a not uncommon Mexican and Central American species.

Sobralia polyphylla *Kränzlin*, p. 173 = **Ponera striata** *Lindley*. It is almost inconceivable that this was described as a species of Sobralia.

Camaridium xylobiichilum *Kränzlin*, p. 174 = **Maxillaria curtipes** *Hooker filius*. This appears to be a rare species which has been recorded only from Mexico so that it may be that the specimen studied by Kränzlin is from Mexico although the locality and collector were unknown to him.

Macradenia mexicana *Kränzlin*, p. 175 = **Cranichis sylvatica** *Richard & Galeotti*, probably. The type specimen is an inflorescence in liquid and although it is probably *Cranichis sylvatica* it might be a closely allied species.

It is difficult to understand how this member of the Neottioid orchids was placed among the genera of the Vanoid orchids in as much as good flowers were present and that it is almost impossible to confuse these two tribes of the Orchidaceae.

Warmingia holopetala *Kränzlin*, p. 176, seems, as far as the inadequate material will permit of study, to be a good species.

Amblostoma tridactylum *Reichb.f.* var. mexicanum *Kränzlin*, p. 177 = **Epidendrum limbatum** *Lindley*. The material is in liquid and not very good, but it leaves little doubt concerning the proper status for this proposed variety.

Habenaria tetrodon *Kränzlin*, p. 178 = **Habenaria strictissima** *Reichb.f.* var. **odontopetala** *(Reichb.f.) L.O.Williams comb. nov.*

(*Habenaria odontopetala* Reichenbach filius in Linnaea 18 (1844) 407).

Although Kränzlin says of this: "Genauer Standort und Sammler unbekannt,aber sicher Südamerikanisch.", there can be no doubt about its identity for it is a perfect match for *H.strictissima* var. *odontopetala.*

HABENARIA AMBLYANTHA *Kränzlin*, p. 179 = **? Habenaria strictissima** *Reichenbach filius.* The petals in Kränzlin's type are narrower than is usual, otherwise it compares favorably. The type consists of an inflorescence in liquid.

NOMENCLATORIAL NOTES. XI

BY

CHARLES SCHWEINFURTH

Scaphyglottis Behrii *(Reichb.f.) Bentham & Hooker filius ex Hemsley* in Godman & Salvin Biol. Centr.-Am. 3 (1883) 219.

Ponera Behrii Reichenbach filius in Bonpl. 3 (1855) 220.

Ponera albida Reichenbach filius Beitr. Orch. Centr.-Am. (1866) 103.

Scaphyglottis guatemalensis Schlechter in Fedde Repert. 2 (April 1906) 133.

Scaphyglottis pauciflora Schlechter in Fedde Repert. 3 (August 1906) 47.

Scaphyglottis albida Schlechter in Beihefte Bot. Centralbl. 36, Abt. 2 (1918) 456.

Scaphyglottis Sanctae Martae Schlechter in Fedde Repert. Beihefte 7 (1920) 122.

Scaphyglottis Bradeorum Schlechter in Fedde Repert. Beihefte 19 (1923) 113.

A large series of specimens from Panama appears to be referable to *Scaphyglottis Behrii* as indicated by the type description and by an analytical drawing from the Reichenbach Herbarium. The lip is drawn as definitely 3-lobed and a similar condition appears to be implied by the words of the description "labello. . . ante medium utrinque plicula elevata transversa medium versus arato".

These specimens show surprising variation vegetatively as to thickness and length of stems and as to length of leaves (leaves not mentioned in the description), but the flowers exhibit very slight differences. To be sure, the type of *Ponera Behrii*, which was a cultivated plant, has fleshy stems consisting of spindle-shaped members; but a garden specimen from Panama (Herb. Ames No.

28051) shows both fleshy stems, similar to those of the type, and narrowly cylindric stems.

The Costa Rican *Ponera albida*, of which we have seen a record of the type from the Reichenbach Herbarium, appears to be a slender-stemmed plant of exactly the same form as much of the Panamanian material of *S. Behrii* and seems to differ from the white-flowered *Ponera Behrii* only in having "ovate" instead of oblong sepals.

The Guatemalan *Scaphyglottis guatemalensis*, of which we have seen a photograph, a drawing and a flower from the type, is typically a tall, slender-stemmed plant with flowers closely similar to those of *Ponera Behrii* and *P. albida*.

Scaphyglottis pauciflora from Costa Rica, as represented by a drawing and floral analysis made under the supervision of Dr. Schlechter, appears to be inseparable from the *Scaphyglottis guatemalensis* form of the species.

Judging from a photograph and a flower of the type number of *Scaphyglottis Sanctae Martae*, supplemented by a floral analysis made under the supervision of Dr. Schlechter, it appears certain that this concept should be reduced to *S. Behrii*. Contrary to Schlechter's comments, the flower possesses the conspicuously stalked ovary which is characteristic of *S. guatemalensis* (and of *S. Behrii*) together with closely similar flower-parts. The only discrepancy between these concepts appears to be in the width of the leaves which are broader in *S. Sanctae Martae* than in most of the forms of *S. Behrii*.

The Costa Rican *Scaphyglottis Bradeorum*, of which we have specimens and a flower from the type collection, is apparently synonymous with *S. Behrii*. It is a slender-stemmed plant with leaves often quite as narrow as those attributed to *S. guatemalensis* and with flowers closely similar to those of that concept.

TWO NEW COMBINATIONS

BY

LOUIS O. WILLIAMS

Stelis rufobrunnea *(Lindl.) L.O.Williams comb. nov.*

Pleurothallis rufobrunnea Lindley Fol. Orch. Pleurothallis (1859) p. 36.

MEXICO: *Arsène 6027, 6373, 6971; Galeotti 5036; Nagel & Navarro 6203; Vera 7122.*

Through the courtesy of Sir A.W.Hill and Dr.V.S. Summerhayes a specimen of Nagel and Navarro has been compared with *Galeotti 5036*, the type of *Pleurothallis rufobrunnea*, and they inform me that there is no appreciable difference in the two specimens. The species is undoubtedly a Stelis.

Pleurothallis rhynchantha *(Reichb.f. & Warsc.) L.O.Williams comb. nov.*

Restrepia rhynchantha Reichenbach filius & Warscewicz in Bonplandia 2 (1854) 114.

Barbosella rhynchantha Schlechter in Fedde Repert. 15 (1918) 263.

This Andian species is referable to *Barbosella* Schlechter, but this genus has been reduced to *Pleurothallis*.